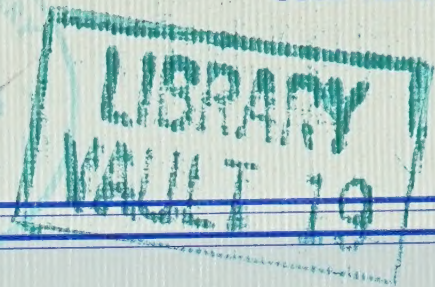
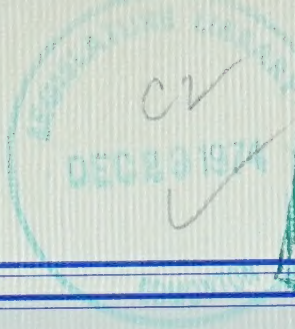


CA2AL&G10  
71R71-B  
C.2

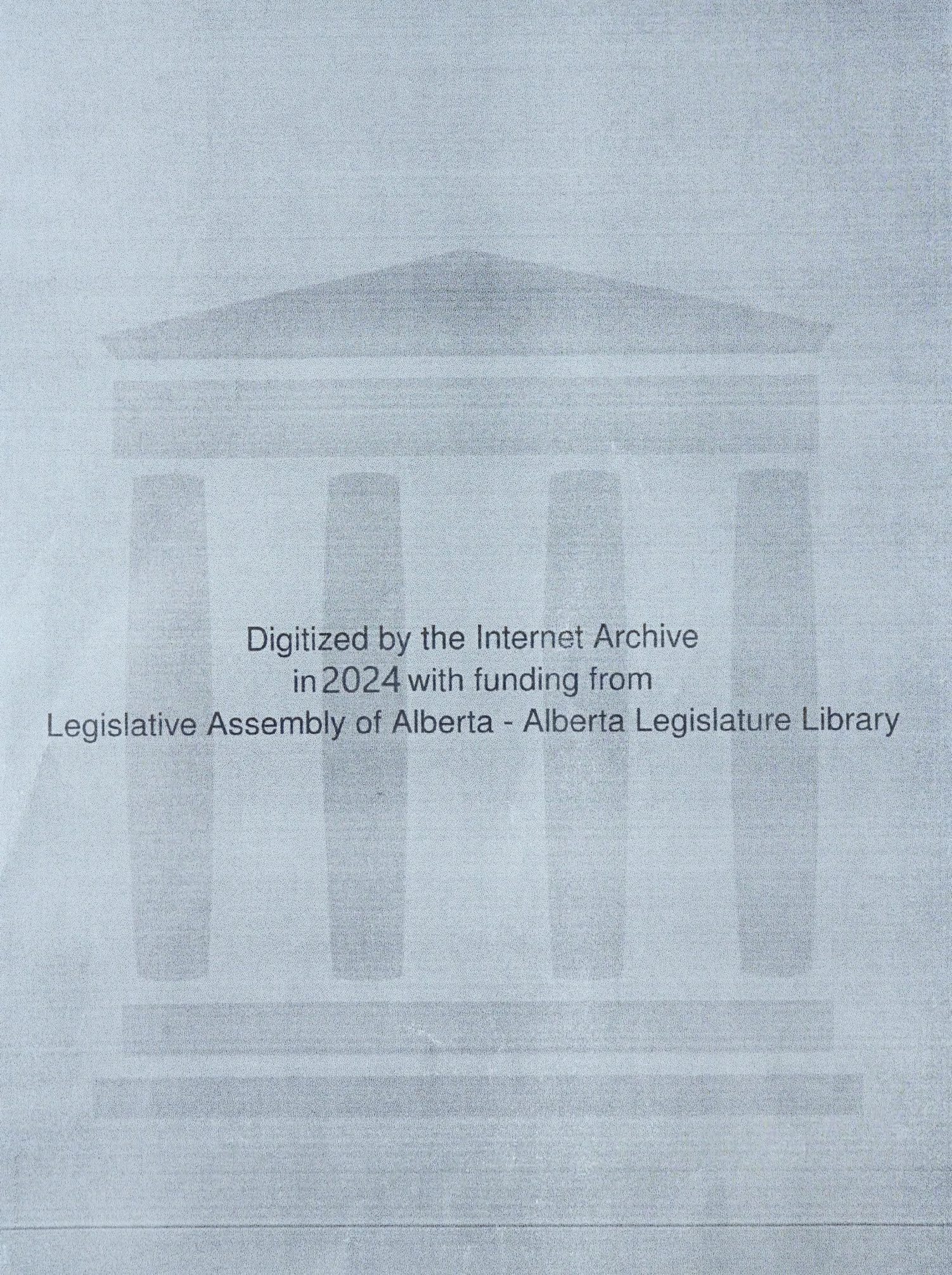


# REPORT AND DECISION REGARDING ALBERTA'S FUTURE REQUIREMENTS FOR GAS

*Alta*  
OIL AND GAS CONSERVATION BOARD

603 SIXTH AVENUE SOUTH WEST • CALGARY 1, ALBERTA





Digitized by the Internet Archive  
in 2024 with funding from  
Legislative Assembly of Alberta - Alberta Legislature Library



TABLE OF CONTENTS


# REPORT AND DECISION REGARDING ALBERTA'S FUTURE REQUIREMENTS FOR GAS

FEBRUARY  
1971

OIL AND GAS CONSERVATION BOARD

603 SIXTH AVENUE SOUTH WEST • CALGARY 1, ALBERTA

PRICE \$5.00



Digitized by the Internet Archive  
in 2024 with funding from  
Legislative Assembly of Alberta - Alberta Legislature Library



## TABLE OF CONTENTS

<u>Section</u>		<u>Page</u>
I	INTRODUCTION.....	1
	Background	1
	Hearing	2
	Guidelines and Heating Value	2
	Volumes	3
	Appearances	3
II	CONSIDERATION OF THE PROVINCE'S FUTURE ENERGY REQUIREMENTS.....	5
III	RESIDENTIAL AND COMMERCIAL GAS REQUIREMENTS.....	13
IV	INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS	42
V	OPERATING REQUIREMENTS OF GAS UTILITY COMPANIES.....	123
VI	PERMIT RELATED GAS REQUIREMENTS.....	129
VII	PEAK DAY GAS REQUIREMENTS.....	148
VIII	FINDINGS.....	162
	1. Residential Gas Requirements	162
	2. Commercial Gas Requirements	163
	3. Industrial and Contingent Gas Requirements	163
	4. Operating Requirements of Gas Utility Companies	164
	5. Permit Related Gas Requirements	165
	6. Total Alberta Gas Requirements	166
	7. Peak Day Gas Requirements	166



# TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
APPENDIX A.....	A-1
Informational Letter No. IL 70-2	
APPENDIX B.....	B-1
Position Statement of the City of Calgary	
APPENDIX C.....	C-1
Review and Comparison of the Energy Forecasts Submitted by Consolidated and Alberta & Southern and TransCanada	



LIST OF TABLES

<u>Table</u>		<u>Page</u>
I-1	Appearances.....	4
III-1	Forecasts of Alberta Residential Gas Requirements.....	39
III-2	Forecasts of Alberta Commercial Gas Requirements.....	40
III-3	Forecasts of Alberta Population.....	41
IV-1	Board Staff-Forecasts of Industrial and Contingent Gas Requirements.....	113
IV-2	Combined Utilities-Forecasts of Industrial and Contingent Gas Requirements.....	114
IV-3	Alberta & Southern and TransCanada (Foster) - Forecasts of Industrial and Contingent Gas Requirements.....	116
IV-4	Consolidated (Hedlin Menzies) - Forecasts of Industrial and Contingent Gas Requirements.....	118
IV-5	City of Edmonton - Forecast of Edmonton Power's Gas Requirements.....	119
IV-6	Board - Forecasts of Alberta Industrial and Contingent Gas Requirements for Power Generation.....	120
IV-7	Board - Forecasts of Alberta Industrial and Contingent Gas Requirements Excluding Power Generation and Peace River.....	121
IV-8	Board - Forecasts of Alberta Industrial and Contingent Gas Requirements for All Uses.....	122
V-1	Board - Forecast of Operating Requirements of Gas Utility Companies.....	128
VI-1	Forecasts of Permit Related Gas Requirements.....	145
VI-2	Detailed Comparison of Forecasts of Alberta Permit Related Gas Requirements..	146



<u>Table</u>		<u>Page</u>
VI-3	Board - Forecast of Alberta Permit Related Gas Requirements.....	147
VII-1	Board - Forecasts of Load Factors and Peak Day Gas Requirements.....	161
VIII-1	Forecasts of Total Alberta Gas Requirements.....	168
C-1	Consolidated (Hedlin Menzies) - Forecast of Energy Requirements, Residential and Commercial Sector.....	C-33
C-2	Consolidated (Hedlin Menzies) - Forecast of Energy Requirements, Industrial Sector...	C-34
C-3	Consolidated (Hedlin Menzies) - Forecast of Energy Requirements, Industrial and Residential and Commercial Sectors.....	C-35
C-4	Consolidated (Hedlin Menzies) - Forecast of Incremental Fossil Fuel Requirements for Power Generation.....	C-36
C-5	Alberta & Southern and TransCanada (Foster) - Forecast of Energy Requirements, Residential and Commercial Sector.....	C-37
C-6	Alberta & Southern and TransCanada (Foster) - Forecast of Energy Requirements, Industrial Sector.....	C-38
C-7	Alberta & Southern and TransCanada (Foster) - Forecast of Energy Requirements, Industrial and Residential and Commercial Sectors...	C-39
C-8	Alberta & Southern and TransCanada (Foster) - Forecast of Fuel Requirements For Power Generation.....	C-41
C-9	Comparison of Consolidated's and Alberta & Southern and TransCanada's Forecasts of Energy Requirements for the Industrial and Residential and Commercial Sectors.....	C-42



Table

Page

C-10	Comparison of Consolidated's and Alberta & Southern and TransCanada's Forecasts of Fuel Requirements for Power Generation.....	C-44
C-11	Average Heating Values of Alberta Fuels	C-46
C-12	Average Fuel Requirements per KWH.....	C-46

(1) Review and discussion of power of the time and the conditions of  
existing facilities under the 1950-1951 agreement.  
Apr. 1950, October 1950.







## I INTRODUCTION

### Background

The Oil and Gas Conservation Board, upon an application by the Alberta Division of the Canadian Petroleum Association, held a public hearing in the summer of 1969 to review its policies and procedures for considering applications under The Gas Resources Preservation Act, 1956. Its conclusions were reported in OGCB 69-D<sup>(1)</sup>.

One of the proposals considered at that time was that periodic hearings be held to determine Alberta's long term requirements for gas and that the requirements so determined, but subject to interim adjustments by methods to be established, be used in consideration of future applications under The Gas Resources Preservation Act, 1956.

The Board's decision to hold periodic requirements hearings is set out in detail on pages 56 to 59 of OGCB 69-D. It decided such hearings should be held every three years, but the interval may be extended when more experience with the procedure is acquired. The scope of the hearings would embrace both the Province's 30-year requirements and the 30th year peak day requirements. Formulas for interim adjustments for requirements for delivery and "cushion" gas requirements were adopted. The Board expressed its intention to call its first requirements

---

(1) Report and Decision on Review of Policies and Procedures for Considering Applications under The Gas Resources Preservation Act, 1956. October 1969.



hearing for mid-April 1970.

### Hearing

After receiving some representations regarding the time needed to prepare submissions, the Board set July 2, 1970, as the opening date of the first requirements hearing, and the hearing was held on that date and July 3 and July 6, 1971, with G. W. Govier, P. Eng., A. F. Manyluk, P. Eng. and Vernon Millard sitting.

### Guidelines and Heating Value

To provide guidance for the preparation of submissions and to ensure that submissions by the various parties would be on a comparable basis, the Board on January 20, 1970, issued Informational Letter No. IL 70-2, which is reproduced in this report as Appendix A. The guidelines in the Informational Letter related to the scope of the hearing, definition of the 30-year period (January 1, 1970 to December 31, 1999), heating value and categories of consumption.

At the opening of the hearing, the Chairman stated that the paragraph in the Informational Letter regarding heating value should have stated simply that estimates of future requirements should be expressed in terms of cubic feet of 1,000 Btu gas. As to the relationship between volumes of 1,000 Btu gas and volumes of actual marketable gas, he said, "The Board's practice..... is to convert energy requirements to volumes of gas at 14.65 psia and 60°F. by using the best available information on the higher heating value per cubic foot of dry marketable gas at 14.65 psia and 60°F. In the Board's opinion, the use of the



heating value of dry gas closely approximates the conditions under which gas is actually delivered to markets. The Board understands that some of the heating values which have been supplied to it by industry have not been for dry gas. It would welcome having these instances drawn to its attention by any interested party and will make adjustments where they appear warranted."

### Volumes

In this report, all volumes of gas are calculated on a 1,000 Btu basis unless otherwise expressly stated. The total 30-year volumes have been rounded. The average annual growth rates to achieve requirements in the terminal year have been calculated using 1970 as the base year.

### Appearances

The interveners<sup>(2)</sup> at the hearing are listed on Table I-1. The Board's Solicitor, N. A. Macleod, Q.C., appeared as its counsel.

Shell appeared for the purpose of cross-examination and argument only.

---

(2) The term "intervener" as used by the Board is defined in section 1601, clause (d) of the Oil and Gas Conservation Regulations. It reads in part: "intervener", when used in connection with proceedings commenced by the Board....., means a person who files a submission. In the proceedings dealt with in this report, therefore, the Board staff is an intervener, as is each other party who presented a submission.

TABLE I-1

## APPENDICES

Abbreviation of Name Used in Report		Represented By	Witnesses
City of Edmonton		A.F. Macdonald, Q.C. W. D. Kirkland, P.Eng.	S.J. Hampton, P. Eng. W. D. Kirkland, P. Eng.
The Alberta Gas Trunk Line Company Limited	Trunk Line	G. R. Forsyth	F. S. Smith
Consolidated Natural Gas Limited	Consolidated	G. D. Nichols	N. J. Lashuk, P. Eng. W. R. Lee (of Hedlin Menzies & Associates Ltd.) D. W. Ross (of Hedlin Menzies & Associates Ltd.)
Alberta and Southern Gas Co. Ltd.	Alberta & Southern	R.A. MacKimmie, Q.C.) R.J. Ludgate ) F.A. Pieroway )	(L. G. Hurd (of Alberta (and Southern) (H. P. Simon (of Foster ( Economic Consultants ( Ltd.)
Trans-Canada Pipe Lines Limited	TransCanada	B.V. Massie, Q.C.	B.M. Dafoe, P. Eng. D.B. Smith, P. Eng. B. W. Snyder, P. Eng.
Canadian Western Natural Gas Company Limited, Northwestern Utilities, Limited and Northland Utilities Limited	Combined Utilities	F.W. Kelly	C. R. Mattinson
Canadian Petroleum Association	CPA	A. A. Phillips	R. G. Woolley
Pacific Petroleum Ltd.	Pacific	S.J. Helman, Q.C. K. Moore	G. H. Cornish, P.Eng.
City of Calgary		C. R. Fetherston	
Shell Canada Limited	Shell	J. S. Rimell	J. S. Rimell G. A. Warne, P. Eng.
Board Staff			



## II CONSIDERATION OF THE PROVINCE'S FUTURE ENERGY REQUIREMENTS

This section considers the views expressed by the interveners on the desirability of undertaking a comprehensive study of the Province's future requirements for all forms of energy. The merits of such a study were discussed by some interveners in relation to the specific problem of estimating the Province's future gas requirements. Two of the submissions, those of Consolidated and Alberta & Southern and TransCanada, presented detailed estimates of the Province's future energy requirements. Consolidated contended that future requirements for gas should be determined only after total energy requirements had been established. The submission of Alberta & Southern and TransCanada placed less emphasis on the importance of an energy forecast, but nevertheless examined the estimates of gas requirements in relation to requirements for other forms of energy. The Cities of Calgary and Edmonton stated that, although they had not prepared forecasts of the Province's future energy requirements in connection with the gas requirements hearing, they believed a study of provincial energy requirements should be made in the near future. These interveners supported such a study not only for the purpose of improving estimates of future gas requirements, but also from the wider point of view of developing appropriate policies for the utilization of all forms of energy within the Province. The issues raised by the interveners and the conclusions reached by the Board are discussed below.

### Views of the Board Staff

The estimates of gas requirements submitted by the Board staff were not accompanied by forecasts for other forms of energy. At the hearing, the witnesses for the staff affirmed that the gas requirements had been estimated largely without reference to the Province's total energy requirements. The staff believed that it was useful to examine the historical relationship between natural gas and other forms of energy. However, the Board staff expressed some reservations about employing this type of analysis over a 30-year forecast period, mainly because of the difficulty of predicting trends in the prices of competing fuels. The staff stated that only limited resources were available for forecasting purposes and, within the context of the hearing, believed it was appropriate to place the major emphasis on natural gas requirements.

### Views of the City of Calgary

The position statement which the City of Calgary submitted at the gas requirements hearing is reproduced in Appendix B of this report. The City did not present estimates of the Province's future gas requirements. However, in its position statement, the City drew attention to the fact that the estimates of gas requirements submitted by other interveners were in reasonably close agreement. The two major concerns of the City related, firstly, to the future growth in the power load on the electric systems operated by itself and the City of Edmonton and, secondly, to the availability of fuel supplies for power generation. Consequently, the



City recommended that the Board should request the Provincial Government to undertake a study of the Province's future energy requirements. The City stated that it was prepared to accept the levels of gas requirements determined by the Board as a result of the hearing, bearing in mind that the requirements would be re-examined at future hearings. The City believed that the adequacy of the Board's estimates could be appraised more fully when the proposed energy study had been completed.

#### Views of the City of Edmonton

The City of Edmonton presented estimates of Edmonton Power's future gas requirements, which were based on the anticipated growth of electricity consumption in the Edmonton area. At the hearing, the witnesses for this intervener emphasized their support for the energy study proposed by the City of Calgary. The witnesses believed that such a study would improve the estimation of the Province's future gas requirements and recommended that the study should be updated every three years. The City also believed that an energy study was desirable from the point of view of developing appropriate policies regarding the use of the Province's coal for power generation by electric utilities outside Alberta. Pending completion of the proposed study, the City was of the opinion that the Board should determine Edmonton Power's gas requirements on the basis of the evidence submitted at the hearing. Finally, the City recommended that the responsibilities of the Oil and Gas Conservation Board should be enlarged to include all forms of energy.

### Views of the Combined Utilities

In preparing estimates of the Province's future gas requirements, the Combined Utilities followed the procedures employed in their previous submissions and did not give detailed consideration to requirements for other forms of energy. The Combined Utilities tendered as an exhibit a table comparing the gas requirements estimated by all the interveners. It was the submission of the Combined Utilities that, when appropriate adjustments were made to all the forecasts, the majority of the differences could be explained by variations in the estimates of gas requirements for Edmonton Power and Peace River Mining & Smelting Ltd. In the closing argument for the Combined Utilities, counsel stated that he doubted whether the question of an energy study, as proposed by the City of Calgary, was within the terms of reference of the hearing. However, the Combined Utilities indicated their willingness to participate in such a study.

### Views of CPA

CPA did not submit estimates of the Province's future gas requirements. The Association is planning to undertake a study of future requirements for gas in Alberta and Canada as a whole, and will base future submissions on the results of this study. It was CPA's view that a study of future gas requirements should take account of the impact of demographic trends on overall energy consumption. CPA expressed the belief that it was important to assess the supply of and demand for all forms of energy, with special emphasis on the role of relative prices.



### Views of Alberta & Southern and TransCanada

The two interveners presented a joint submission which was prepared by Foster Economic Consultants Ltd. (Foster). In addition to estimating the Province's future gas requirements, Foster performed forecasts for other forms of energy. Foster emphasized that, in the main, the forecasts for natural gas and other forms of energy had been developed independently of each other. The principal purpose of examining requirements for energy sources other than natural gas was to determine whether the estimates for natural gas were reasonable when viewed in relation to estimates of requirements for all forms of energy. Foster stated that the natural gas forecast had received more attention than the forecasts for other forms of energy, and agreed with the Board staff that this emphasis was appropriate within the context of the hearing. Mr. Simon of Foster stated that, in his personal opinion, there was considerable merit in the City of Calgary's proposal for a study of provincial energy requirements.

### Views of Consolidated

Consolidated's submission was prepared by Hedlin Menzies & Associates Ltd. (Hedlin Menzies). Hedlin Menzies derived the Province's future gas requirements from a forecast of total energy requirements within the Province. It was Hedlin Menzies' submission that forecasts of overall energy consumption were generally reliable, since the factors affecting historical energy requirements could be established by statistical analysis. For this reason, Hedlin Menzies stated that it was important to ensure

that the forecasts for natural gas and other forms of energy were consistent with estimates of total energy requirements. Hedlin Menzies stated that estimates of natural gas requirements which were derived in this manner had the additional advantage of giving specific recognition to the major considerations underlying the choice between different fuels. In the absence of such considerations, Hedlin Menzies believed there would be a tendency to overestimate natural gas requirements, especially in forecasts which relied on surveys of natural gas customers. Hedlin Menzies believed that surveying techniques were useful mainly in the context of short-term forecasts.

#### Views of the Board

The Board has reviewed the opinions expressed by the interveners on the desirability of considering the Province's future gas requirements in relation to requirements for all forms of energy. In addition, the Board has noted the City of Calgary's proposal for a comprehensive study of provincial energy requirements and the recommendation of the City of Edmonton that an agency responsible for all forms of energy should be established in the Province. The Board does not believe that the matters raised by the two Cities fall within the terms of reference of the hearing but, as requested, the Board has conveyed the two suggestions to the Provincial Government. The Government of Alberta's views on these matters were outlined in the Speech from the Throne on February 11, 1971.

In assessing the Province's future gas requirements, the



Board would wish to take into account all the evidence which was relevant to the subject matter of the hearing. The Board recognizes that the Province's future gas requirements will be affected by the level of total energy requirements and by the terms on which gas can be expected to compete with other forms of energy. Therefore, the Board agrees with the view that it is preferable to consider gas requirements in relation to requirements for all forms of energy. However, the Board believes that it would be difficult to undertake an extensive review of the Province's future energy requirements within the context of a gas requirements hearing. Furthermore, the Board observes that the estimates submitted by the interveners demonstrated reasonably close agreement regarding several important aspects of the Province's future gas requirements. For these reasons, the Board's appraisal of the evidence on energy requirements has been limited to instances where significant differences existed between the interveners' estimates of gas requirements.

The Board has had particular regard for the evidence relating to electricity consumption. The Board agrees with the view expressed by a number of interveners that electricity will enjoy substantial growth over the 30-year forecast period and will be the major alternative to gas as a source of energy. An important concern is the extent to which gas will be used to generate the electricity needs of the Province. In considering the impact of future electricity consumption, the Board has referred to the energy forecasts prepared by Foster and Hedlin Menzies, as well as the evidence submitted by the other interveners. The Board's

appraisal of the energy forecasts has been complicated by the fact that the two forecasts were compiled on a different basis. However, the Board has reviewed both forecasts in Appendix C of this report and has made a number of adjustments to the forecasts in order to permit a broad comparison of the estimates.



### III RESIDENTIAL AND COMMERCIAL GAS REQUIREMENTS

---

This section summarizes the evidence and presents the views of the Board on the Province's residential and commercial gas requirements. The two types of requirements are described in Informational Letter No. IL 70-2<sup>(1)</sup>. Although evidence on population and related matters is applicable to both types of requirements, the Board favours the preparation of separate forecasts for residential and commercial gas requirements, as recommended in the Informational Letter. The Board notes that the various interveners prepared their forecasts in this manner. Separate forecasts of residential and commercial gas requirements were submitted by the Board Staff, the Combined Utilities, Consolidated, and Alberta & Southern and TransCanada. In addition, the City of Edmonton and the CPA made reference to the Province's residential and commercial gas requirements in their evidence.

#### Views of the Board Staff

The Board staff presented estimates of future residential and commercial gas requirements for each of the fifteen census divisions of the Province. The requirements of each census division were obtained by applying estimates of per capita consumption to a forecast of population in areas served by gas

---

(1) The Informational Letter is reproduced in Appendix A. Throughout this report, residential requirements are to be identified with the domestic demand category defined in IL 70-2.

within the census division. The forecasts of provincial residential and commercial gas requirements were obtained by summing the projections of requirements for the various census divisions. For the Province as a whole, the population residing in market areas served by gas was projected to increase from 1,216 thousand in 1970 to 2,541 thousand in 1999, equivalent to an average annual growth rate of 2.6 per cent. The per capita rates of residential consumption applying to this population were forecast to decline from some 48 thousand cubic feet in 1970 to 46 thousand cubic feet in 1999. The per capita rates of commercial consumption, on the other hand, were forecast to increase from 42 thousand cubic feet in 1970 to some 44 thousand cubic feet in 1999. The Board staff's estimates of Alberta's future residential and commercial gas requirements for the period 1970 to 1999 are outlined below.

(1) Residential

The Province's residential gas requirements were forecast by the Board staff to increase from 58 billion cubic feet in 1970 to some 116 billion cubic feet in 1999 and to total 2,590 billion cubic feet over the 30-year period. This forecast is presented on an annual basis in column (1) of Table III-1.

(2) Commercial

The Board staff estimated that the Province's commercial gas requirements would increase from 51 billion cubic feet in 1970 to some 113 billion cubic feet in 1999. Column (1) of Table III-2 presents the forecast on an annual basis and shows that these requirements are expected to total 2,423 billion cubic feet over the 30-year period 1970 to 1999.

The Board staff noted that both residential and commercial per capita consumption rates had shown an upward trend in the Province as a whole during the historical period 1965 to 1969. The projected decline in residential rates was mainly a reflection of the trends forecast for market areas in census divisions 6 and 11, which contain Calgary and Edmonton, respectively. It was the staff's opinion that a high density of residential sales had been achieved in these and most other market areas of the Province. The Board staff anticipated that the proportion of the population living in apartments would increase over the forecast period. Under these circumstances, the intervener believed that provincial residential per capita consumption would decline over the 1970 to 1999 period. At the hearing, it was noted that the residential per capita consumption rate in census division 11 had increased marginally over the 1965 to 1969 period at a time when apartment households accounted for some 75 per cent of the new dwellings constructed. Mr. Rimell, witness for the intervener, testified that the Board staff believed the potential residential demand for natural gas in this market area had not been fully exploited in the period up to 1965, and that the increase in per capita consumption rates over the 1965 to 1969 period reflected increasing penetration. The Board staff assumed a saturation level for natural gas had been reached by the end of 1969 and, therefore, that the historical trend in residential per capita consumption rates would not continue over the forecast period. Provincial commercial per capita consumption rates were forecast to increase in the period 1970 to 1999, partly as a result of the trend



towards apartment living. The increases were also associated with the growth of non-apartment commercial sales in urban areas.

The Board staff's projection of provincial population served by gas reflected estimated trends in urban and rural population distributions within the various census divisions of the Province. Historical data included in the staff's submission indicated that the proportion of the provincial population residing in urban centres had increased from some 57 per cent in 1956 to some 71 per cent in 1969.<sup>(2)</sup> The intervener estimated that this trend would continue over the forecast period and that the urban proportion of the provincial population would reach some 90 per cent by 1999. Under these conditions, the Province's urban population was forecast to increase from 1,100 thousand in 1969 to 2,477 thousand in 1999. During the same period, the Province's rural population was expected to decline from 458 thousand to some 286 thousand. Within each census division, the growth rates estimated for the urban and rural populations were applied to the urban and rural segments of the population in areas served by gas. In some census divisions, the growth of population in areas served by gas was augmented by estimates of the population in areas not currently served but expected to be connected to the gas supply during the forecast period. The staff noted that virtually all urban areas were served by gas at the beginning of the forecast period, whereas the great majority of rural areas were not served by gas. The growth in population served, from a level of 1,181

---

(2) The Board staff defined urban centres to be those communities with populations equal to or greater than 1,000 persons.

thousand in 1969 to 2,541 thousand in 1999, was mainly a reflection of the relatively high growth rates projected for urban as opposed to rural areas of the Province.

The Board staff's projections of total population by census division utilized the component method of population forecasting. As this method of forecasting attempts to simulate the actual process of population growth, basic assumptions regarding fertility rates, the ratio of male to female births, mortality rates and net migration are important to the model.

Estimates of Alberta population by census division were based on projections of provincial fertility rates. The Board staff assumed that the historical declines evident in provincial age-group fertility rates would continue through 1981 but that the rates would remain constant thereafter at the 1981 level. Testimony at the hearing indicated that the total fertility rate for all age groups was projected at 2,650 in 1980, a rate in excess of that prevailing for Canada as a whole in 1968. Mr. Rimell stated that while there exists a consensus that Alberta rates will continue to decline from historical levels, there is widespread disagreement as to the extent of the decline. He noted that historically Alberta rates have been higher than those for Canada as a whole. Mr. Rimell agreed that a reduction in Alberta fertility rates from the levels assumed in the forecast would reduce the population projection, provided other factors remained unchanged. The intervener believed that fertility was the most important of the components in the population forecast. The staff noted that errors in projecting fertility rates can have considerable impact

on the accuracy of population forecasts due to the absolute numbers involved and the compounding effect introduced by female births early in the forecast period. Mr. Rimell testified that he believed the fertility rate projections of the Board staff to be realistic on average over the long term.

As with fertility, provincial age-group mortality rates were utilized in the projections of population by census division. Generally, this meant employing the average level of mortality established between 1956 and 1966. Exception to this practice did, however, occur where historical changes indicated that extrapolation appeared warranted. All projections beyond 1981 were held constant at 1981 levels. The Board staff noted in its submission that because mortality rates were generally low, relatively large percentage errors could be sustained with only a minor influence on the population forecast.

The population projection for Alberta assumed net provincial immigration in the order of 11,000 persons per annum over the forecast period. The net migration of individual census divisions recognized intraprovincial as well as extraprovincial population movements. The influence of this factor varied between census divisions in accordance with historical experience and expected industrial development. Some variation was permitted in the annual provincial projection to allow for the impact of anticipated industrial developments.

The projections of total population by census division for the 1970 to 1999 period were based on actual 1966 population data. The summation of the census division projections resulted



in the forecast of provincial population shown in column (1) of Table III-3. Total provincial population was forecast to increase from 1,589 thousand in 1970 to 2,763 thousand in 1999, equivalent to an average annual growth rate of 1.9 per cent.

#### Views of the Combined Utilities

The Combined Utilities presented separate forecasts of residential and commercial gas requirements for their service areas and for the remainder of the Province.<sup>(3)</sup> Provincial residential and commercial requirements were projected by summing the respective service area forecasts.

The requirements of the Combined Utilities' service areas were forecast by applying estimates of per capita consumption to a projection of population served. The population residing in the Combined Utilities' service areas was forecast to increase from 1,143 thousand in 1970 to 2,443 thousand in 1999. Residential per capita consumption was estimated to increase marginally from 45.5 thousand cubic feet in 1969 to 45.7 thousand cubic feet in 1970. Such consumption was projected to decline to 45.6 thousand cubic feet in 1971 and to remain constant at that level over the balance of the forecast period. Per capita rates of commercial consumption were forecast to increase from 42.6 thousand cubic feet in 1970 to 45.3 thousand cubic feet in 1978, thereafter remaining constant

---

(3) The Remainder of the Province comprises the Medicine Hat-Redcliffe area, the communities on the Plains Western system and those municipalities having independent distribution systems.

at the 1978 level for the duration of the forecast period.

Residential and commercial gas requirements in market areas not served by the Combined Utilities were projected by applying an average annual growth rate of 2 per cent to actual 1969 consumption.

The Combined Utilities' projections of provincial residential and commercial gas requirements are presented below.

(1) Residential

Provincial residential gas requirements were forecast to increase from some 59 billion cubic feet in 1970 to 123 billion cubic feet in 1999. As shown in column (2) of Table III-1, 30-year requirements were projected to total 2,662 billion cubic feet.

(2) Commercial

Alberta's commercial gas requirements were forecast to increase from some 52 billion cubic feet in 1970 to 116 billion cubic feet in 1999. Annual requirements, as presented in column (2) of Table III-2, were projected to total 2,500 billion cubic feet over the 30-year forecast period.

The population projection used in the forecast of the residential and commercial requirements of the Combined Utilities' service areas was based on historical trends. Edmonton and Calgary populations were each assumed to increase by 15,000 persons per annum until their respective annual growth rates reached 2.5 per cent, at which point the latter rate was adopted for the remainder of the forecast. Population in the remaining communities served by the Combined Utilities was estimated to grow at an average annual

rate of 2 per cent over the 1970 to 1999 period. This provision was considered adequate to cover the populations of those communities not presently served by gas but which are expected to be connected during the forecast period. Mr. Snyder, a witness for the Combined Utilities, stated that this growth rate did not apply to rural areas.<sup>(4)</sup> An additional allowance was made in the population projection for the extension of service to rural customers. The Combined Utilities estimated that gas service would be extended to 1,200 such customers annually in the early years of the forecast, gradually declining to a level of 400 to 500 in the later years.

At the hearing, the Combined Utilities said that they had not made a study of population served in the remainder of the Province. Mr. Snyder stated that because no such study had been undertaken, the Combined Utilities could not offer an opinion on the acceptability of the Board staff's projection of provincial population served. He did, however, note that the forecasts of Alberta's residential and commercial requirements contained in the two submissions were in close agreement. On this basis, he felt the Board staff projection of population served could be considered reasonable.

The Combined Utilities did not prepare a forecast of total population in the Province. At the hearing, Mr. Snyder said that the Combined Utilities could not offer advice on the growth of

---

(4) The Combined Utilities define rural areas to be those distribution systems serving less than six customers.



provincial population outside the Cities of Calgary and Edmonton. Mr. Snyder cautioned the Board against using a 2 per cent average annual growth rate for the population residing outside these Cities. He believed this growth rate would not be applicable to the rural areas of the Province.

#### Views of Consolidated

Hedlin Menzies & Associates Ltd. (Hedlin Menzies), which prepared the submission for Consolidated, projected the Province's residential and commercial gas requirements for the period 1970 to 1999 within the context of the total energy requirements of the combined residential and commercial sector. As discussed in Appendix C, Hedlin Menzies estimated that the total energy requirements of the combined sector would increase from 142 trillion Btu's in 1970 to 275 trillion Btu's in 1999. Hedlin Menzies expressed the belief that 76 per cent of the annual total energy requirements of the combined sector would be supplied by gas. Separate forecasts of provincial residential and commercial gas requirements were derived in the manner described below.

##### (1) Residential

The residential sector's share of combined residential and commercial gas requirements was estimated to decline from 53.3 per cent in 1969 to 48.0 per cent in 1999. Column (3) of Table III-1 shows that the residential requirements for natural gas were estimated to increase from 57 billion cubic feet in 1970 to 100 billion cubic feet in 1999. Thirty-year requirements were projected to total 2,428 billion cubic feet.

(2) Commercial

With trends to urbanization and apartment living expected to continue, Hedlin Menzies estimated that the commercial demand for gas would account for an increasing share of combined residential and commercial gas requirements over the forecast period. Commercial requirements were forecast to increase from some 51 billion cubic feet in 1970 to some 109 billion cubic feet in 1999. Thirty-year requirements were estimated to total 2,411 billion cubic feet, as shown in column (3) of Table III-2.

The forecast of gas requirements for the combined residential and commercial sector was derived by estimating the proportion of total energy supplied by natural gas. It was Hedlin Menzies' opinion that natural gas would remain the major source of energy in this sector over the forecast period. However, Hedlin Menzies believed that the natural gas share of total energy in the combined sector would increase only marginally, from 75.3 per cent in 1969 to 76.0 per cent in 1999. Testimony at the hearing indicated that the natural gas share had been projected to reach 76.0 per cent in 1970 and to remain at that level through the balance of the forecast period. Mr. Lee, a witness for the intervener, stated that the projection of residential and commercial gas requirements reflected anticipated growth in the demand for electricity. Hedlin Menzies assumed that electricity consumption would increase at an average annual growth rate of 5 per cent over the forecast period. As a result, electricity's share of the total energy requirements of the combined sector was forecast to increase from

9.0 per cent in 1969 to 20.0 per cent in 1999. In further testimony, the witness stated that electricity was assumed to increase its share of the total energy requirements at the expense of energy sources other than natural gas.

Hedlin Menzies projected the total energy requirements of the combined residential and commercial sector using a linear equation relating total energy to the number of households. On the basis of the results obtained from regression analyses, Hedlin Menzies concluded that households provided a better explanation of historical changes in energy requirements than other available indicators, such as population and per capita income. The method used by Hedlin Menzies to project the combined residential and commercial sector's total energy requirements is discussed in Appendix C.

Hedlin Menzies estimated that the number of households in Alberta would increase from 442 thousand in 1970 to 758 thousand in 1999. The household forecast was based on anticipated trends in the number of persons per household and a projection of provincial population.<sup>(5)</sup>

Hedlin Menzies projected persons per household in Alberta by applying estimated growth rates of persons per household in Canada, forecast by the Economic Council, to actual 1966 Alberta data. It was estimated that the number of persons per household in Alberta would decline by some 11 per cent over the 1966 to 1981 period

---

(5) Hedlin Menzies assumed 3 per cent of the projected population would reside in collective institutions and would therefore not influence the growth of households.



and remain constant at the 1981 level through the balance of the forecast period. In absolute terms, Alberta per household population was forecast to decline from 3.60 in 1966 to 3.21 in 1981.

The projection of Alberta population included in the Consolidated submission utilized a component method of population forecasting developed by the City of Calgary. The forecasts for the various components of population growth were prepared by Hedlin Menzies. A continuing decline was recognized in provincial fertility rates. The population projection assumed that this decline would prevail through 1980, reducing the total fertility rate of all age groups from 2,795 in 1968 to an estimated 2,375 in 1980. The total fertility rate over the remainder of the forecast period was projected at the 1980 level. It was further assumed that live births would be in the ratio of 105.7 males to 100 females. At the hearing, Mr. Lee of Hedlin Menzies agreed with the Board staff's view that fertility represented the single most important component in determining population growth. Provincial mortality rates were projected to remain constant throughout the forecast period at the 1966 levels. The significance of the mortality rates to the overall population projection was considered minor. Hedlin Menzies believed the level of net immigration prevalent in Alberta over the 1960's to be indicative of future trends. Accordingly, net provincial immigration totalling 7,500 persons per annum was forecast over the 1970 to 1999 period. The net immigration was assumed to be made up

equally of males and females and to be distributed by age group in a constant manner.

Relating the assumptions outlined above to the Dominion Bureau of Statistics' estimate of Alberta's population as at June 1, 1969, Hedlin Menzies estimated that the population of Alberta would increase from 1,589 thousand at June 1, 1970 to 2,508 thousand as at June 1, 1999. This represented an average annual growth rate of 1.6 per cent. The projection of Alberta population for the forecast period 1970 to 1999 is outlined in column (2) of Table III-3.

#### Views of Alberta & Southern and TransCanada

The forecasts of residential and commercial gas requirements submitted by Alberta & Southern and TransCanada were prepared by Foster Economic Consultants Ltd. (Foster). Foster estimated residential gas requirements by applying projected rates of per household consumption to a forecast of residential households served by gas.<sup>(6)</sup> A similar procedure was adopted with respect to the portion of commercial gas requirements associated with apartment households.<sup>(7)</sup> Non-apartment commercial demand was estimated by applying projected rates of per capita

---

(6) Residential households were defined as dwelling units in a building containing two or less dwelling units.

(7) Apartment households were defined as dwelling units in all multi-storied buildings containing more than two dwelling units.

consumption to a forecast of Alberta population. The interveners' forecasts of residential and commercial gas requirements are outlined below.

(1) Residential

Residential households served by gas were projected to increase from 272 thousand in 1970 to 516 thousand in 1999. On the assumption that such households would consume annually an average of 210 thousand cubic feet of gas over the forecast period, Foster estimated that Alberta's residential requirements would increase from 57 billion cubic feet in 1970 to some 108 billion cubic feet in 1999. Thirty-year requirements, as presented in column (4) of Table III-1, were projected to total 2,430 billion cubic feet.

(2) Commercial

The projection of Alberta's commercial gas requirements was determined by summing projections of apartment and non-apartment commercial demand. Foster estimated that apartment households served by gas would increase from 82 thousand in 1970 to 295 thousand in 1999. Foster assumed that such households would consume annually an average of 128 thousand cubic feet of gas over the forecast period. As a result, apartment demand was estimated to total 669 billion cubic feet over the 1970 to 1999 period. Per capita consumption rates for non-apartment commercial demand were forecast to increase from 25.3 thousand cubic feet in 1969 to 29.0 thousand cubic feet in 1980, thereafter remaining constant at the 1980 level for the balance of the forecast period.



Applying the estimated consumption rates to a projection of provincial population, Foster forecast that non-apartment commercial demand would increase from 41 billion cubic feet in 1970 to 85 billion cubic feet in 1999 and total 1,883 billion cubic feet over the 30-year forecast period. On the basis of the forecasts of apartment and non-apartment demand, Foster estimated that commercial gas requirements would increase from some 52 billion cubic feet in 1970 to 123 billion cubic feet in 1999. As shown in column (4) of Table III-2, 30-year requirements were estimated to total 2,553 billion cubic feet.

Foster estimated the total number of households in the period through 1999 by applying a National Energy Board forecast of persons per household to a projection of Alberta population. The number of persons per household was assumed to decline from 3.67 in 1970 to 3.38 in 1999. The total number of households was expected to increase from 434 thousand in 1970 to 868 thousand in 1999. Foster assumed that all new households would be located in urban areas and that these households would be natural gas consumers.

The forecast of total households was broken down between residential and apartment households. Apartment households were projected by applying the growth rates of a similar National Energy Board forecast to an estimate of the number of apartment households in 1969. On this basis, apartment households were forecast to increase from 82 thousand in 1970 to 295 thousand in 1999. Foster estimated that all apartment households were served by gas in 1969 and therefore that all such households would be served by gas

over the forecast period.

A forecast of residential households in Alberta was obtained by deducting the forecast of apartment households from the projection of total households. The forecast of residential households served by gas was determined by adding to the number of residential customers existing in 1969 the projected increase in residential households and an estimate of the number of new customers to be served by plastic pipe. The plastic pipe program, used primarily to extend gas service to rural communities and households which previously could not be served economically, was expected to add 1,200 customers per year in the 1970 to 1974 period and an additional 20,000 customers over the balance of the forecast period. In total, the number of residential households served by gas was forecast to increase from 272 thousand in 1970 to 516 thousand in 1999, equivalent to an average annual growth rate of 2.2 per cent.

The population projection underlying Foster's forecast of households was based on a projection prepared by the Alberta Bureau of Statistics (ABS). The ABS projection utilized the component method of population forecasting. Foster's forecast of population for the period 1970 through 1986 was derived by applying the average annual growth rates in the ABS forecast to the Dominion Bureau of Statistics' intercensal estimate of Alberta's 1969 population. Foster assumed that Alberta's population would increase over the balance of the forecast period at the average annual growth rate estimated by the ABS for the years 1984 to 1986.

As shown in column (3) of Table III-3, Foster projected that Alberta's population would grow from 1,592 thousand in 1970 to 2,932 thousand in 1999. At the hearing, Foster was questioned regarding the assumption in the ABS population forecast that the total fertility rate in Alberta would remain constant at a level of 3,000. Mr. Simon, of Foster, witness for the interveners, stated that he believed the end results of the population forecast to be reasonable. He noted that prior to choosing the ABS forecast as a reference, a number of other projections of Alberta population were considered, all of which were found to have very similar results.

The forecasts of residential and commercial gas requirements were used in conjunction with forecasts for coal, fuel oil and liquid petroleum gases to estimate the total requirements for all types of energy, other than electricity, in the combined residential and commercial sector. As described in Appendix C, the total requirements for the selected types of energy were projected to increase from some 137 trillion Btu's in 1970 to 257 trillion Btu's in 1999. Within the total, the natural gas share was expected to rise from some 80 per cent in 1970 to 90 per cent by the end of the forecast period. At the hearing, Mr. Simon stated that the natural gas shares predicted by Foster and Hedlin Menzies were not comparable, since Hedlin Menzies had included electricity in its forecast of the total energy requirements for the combined residential and commercial sector.

Foster contended that its estimates of total energy requirements resulting from the individual forecasts for natural gas and



other fuels were reasonable when viewed in relation to the National Energy Board's forecast of future energy requirements in the Province. Foster believed that the similarity between the two energy forecasts helped to substantiate the projections of provincial natural gas requirements.

#### Views of the City of Edmonton

The City of Edmonton did not include in its submission forecasts of Alberta's residential and commercial gas requirements. However, the City did express agreement with projections of gas requirements for the Edmonton area prepared by Northwestern Utilities, Limited (NUL). Although in agreement with the projected requirements, Mr. Hampton, witness for the intervener, testified that the City did not agree with NUL's projection of population for the Edmonton area. Based on population projections prepared by the Edmonton Regional Planning Commission, the City estimated that the population of metropolitan Edmonton would increase from 464,000 in 1970 to 1,076,800 in 1999. NUL projected that the population of metro Edmonton would reach 960,500 in 1999.

#### Views of CPA

CPA did not enter as evidence projections of Alberta's residential and commercial gas requirements. However, CPA did testify that it was in general agreement with the projections of such requirements set forth in the various studies submitted by other interveners.

### Views of the Board

The Board has examined the various forecasts of residential and commercial gas requirements presented by the interveners. Although different methods were used to prepare the forecasts, the forecasts themselves are in reasonably close agreement. In terms of 30-year totals, the estimates of residential gas requirements vary from 2,428 billion cubic feet to 2,662 billion cubic feet. The corresponding range for commercial gas requirements is 2,411 billion cubic feet and 2,553 billion cubic feet. The Board believes that the Province's actual residential and commercial gas requirements over the next 30 years will lie within the range suggested by the forecasts of the interveners.

All the interveners believed that the growth in residential and commercial gas requirements would be related either directly or indirectly to the growth of the Province's population. However, the various interveners emphasized different aspects of population growth in preparing their forecasts of requirements. Both Hedlin Menzies and Foster used their population forecasts, in conjunction with estimated trends in the number of persons per household, to develop household forecasts. Hedlin Menzies believed that the total number of households provided the best indication of overall energy requirements in the combined residential and commercial sector. A feature of the statistical relation employed by Hedlin Menzies is that average energy use per household increases with the number of households.<sup>(8)</sup> Foster, on the other hand, estimated the numbers

---

(8) The statistical relationship is discussed in Appendix C.

of residential and apartment households served by gas and assumed that the respective rates of consumption for these households would remain constant over the forecast period. Neither the Board staff nor the Combined Utilities forecast requirements on a household basis. The approaches taken by these two interveners were similar and involved estimating per capita rates of consumption associated with the population living in areas served by gas.

The Board favours an approach which bases residential and commercial gas requirements on developments particular to market areas for gas. The principal advantage of such an approach is that specific recognition may be given to the influence of urbanization, which all the interveners believed would have an important impact on the residential and commercial demand for gas. Therefore, the Board believes that residential and commercial gas requirements should be related to either households served or population served. It is the Board's opinion that both methods of forecasting residential and commercial gas requirements attempt to take account of the influence of similar factors. In the past, the Board has forecast residential and commercial gas requirements on the basis of population served, rather than households. The Board's new estimates of these requirements have also been based on a projection of provincial population served.

The Board notes with interest the forecasts of provincial population presented by the various interveners. Since the growth in population served by gas is related to the growth of total population within the Province, the Board wishes to comment on the estimates of provincial population.



The Board agrees with Hedlin Menzies and the Board staff that estimates of fertility are the single most important feature of a population projection utilizing the component method of forecasting. Having regard for the total Alberta fertility rate in 1968, the Board accepts Hedlin Menzies' opinion that the fertility estimates underlying the population forecast used by Foster are too high. It is the Board's view that the historical decline in provincial fertility rates will continue into the forecast period. However, the Board expects that the decline in fertility will be arrested at a level somewhat higher than assumed in the Hedlin Menzies forecast. As regards levels of net immigration, the Board feels that the projection of the Board staff overstated the influence of this factor. In the Board's opinion, a reasonable forecast of provincial population will lie within the bounds established by the projections of Hedlin Menzies and the Board staff. The Board believes that the future population of the Province can be approximated by using the average of these projections. On this basis, the Board estimates that Alberta's population will increase from 1,589 thousand in 1970 to 2,636 thousand in 1999.

Evidence relating to population growth indicated that a significant trend to urbanization was anticipated over the forecast period. All the interveners referred to this aspect of population growth and two of the submissions, those of the Board staff and Foster, embody specific assumptions about the growth of population in urban centres. The Board staff believed that the growth of urban areas would be associated with a continuing decline in the rural population. It was Foster's contention that all new household

formation would be located in urban centres and hence that the number of households in rural areas would remain static over the forecast period. However, since Foster predicted a decline in the number of persons per household, the assumption of a constant number of rural households implies a decline in the rural population. The Board concurs with the view that a portion of the rural population will continue to migrate to urban centres over the forecast period. Because many rural areas are not connected to the gas supply at the present time, population movements from rural to urban areas are likely to have a considerable impact on future residential and commercial gas requirements, as virtually all urban areas were served by gas at the beginning of the forecast period. The proportion of the population served by gas will be further augmented over the forecast period by the extension of gas served to some rural areas, primarily as a result of the plastic pipe program. On the basis of migration from rural to urban areas, and the addition of new customers through the plastic pipe program, the Board expects that the population served by gas will show a greater increase than will the total population. The Board has found that, in the staff's forecast, the proportion of the total provincial population served by gas was expected to increase from some 77 per cent in 1970 to some 90 per cent in 1994 and to reach some 92 per cent by 1999. The Board has adopted the Board staff's estimates of the proportion of total provincial population served by gas through 1994, and has retained this proportion through the final years of the forecast. On this basis

the Board expects that the population in areas served by gas will increase from some 1,216 thousand in 1970 to some 2,375 thousand in 1999.

Several important factors are likely to influence per capita rates of consumption in areas served by gas during the forecast. A decline in number of persons per household will tend to increase per capita rates of both residential and commercial consumption. The balance of the evidence indicated that the number of persons per household was likely to decline during the forecast. The Board accepts this view. Changes in rates of consumption per household may also affect per capita rates. The Board recalls that Hedlin Menzies believed that per household use of all types of energy would increase over the forecast period, whereas Foster submitted that the average rates of gas consumption per household would remain constant. It is the Board's opinion that the average consumption of gas customers may exhibit a modest increase during the forecast, but that this trend is unlikely to have a significant impact on per capita rates. The Board believes that gas, as well as electricity, will be substituted for coal and liquid petroleum fuels during the early part of the forecast and that this will be a further factor tending to increase per capita rates of residential consumption. The Board is of the opinion that the most important development affecting both residential and commercial per capita rates is likely to be a continuing trend to apartment living in urban areas. It is clear that this trend will depress per capita rates of residential consumption and have the reverse effect on per capita rates of commercial consumption.

It is the Board's judgment that, taking into account all the factors, per capita rates of residential consumption are likely to remain constant during the first decade of the forecast. The Board believes that apartment dwellers will account for an increasing proportion of the population in areas served by gas. However, the Board is of the opinion that during this period, the combined effects of a substitution of gas for coal and liquid petroleum fuels and a decrease in the number of persons per household will be sufficient to offset the trend towards apartment living. Accordingly, the Board has held per capita rates of residential consumption constant until 1980 at the level estimated by the staff for 1969. The use of constant per capita rates of residential consumption during this period conforms to the views of the Combined Utilities. The Board foresees only limited opportunities to substitute gas for other fuels after 1980 and in these circumstances believes that the per capita rates of residential consumption will exhibit a gradual decline over the remainder of the forecast period. All of the factors considered by the Board suggest that per capita rates of commercial consumption will exhibit a steady increase over the forecast period. Although the most important of these factors is the trend towards apartment living, declines in the number of persons per household are also likely to be important. In addition, the Board believes that commercial consumption associated with shopping centres, offices and other urban establishments will tend to increase per capita rates of commercial consumption in areas served by gas.



On the basis of its forecast of population served by gas and anticipated trends in per capita rates of consumption, the Board has prepared the projections of residential and commercial gas requirements outlined below.

(1) Residential

Provincial residential gas requirements are forecast to increase from 58 billion cubic feet in 1970 to some 109 billion cubic feet in 1999. Column (5) of Table III-1 shows that 30-year requirements are expected to total 2,536 billion cubic feet.

(2) Commercial

The commercial gas requirements of the Province are forecast to increase from 51 billion cubic feet in 1970 to some 114 billion cubic feet in 1999. As shown in column (5) of Table III-2, 30-year requirements are projected to total 2,448 billion cubic feet.

The Board estimates that the gas requirements of the combined residential and commercial sector will increase from 109 billion cubic feet in 1970 to 222 billion cubic feet in 1999. The Board forecasts show that the residential sector's share of total residential and commercial requirements is expected to decrease from some 53 per cent in 1970 to approximately 49 per cent in 1999. The Board notes that the direction of this trend was supported by the evidence of all the interveners.

TABLE III-1

FORECASTS OF  
ALBERTA RESIDENTIAL GAS REQUIREMENTS  
(BILLIONS OF CUBIC FEET)

YEAR	BOARD STAFF (1)	COMBINED UTILITIES (2)	CONSOLIDATED (HEDLIN MENZIES) (3)	ALBERTA & SOUTHERN AND TRANSCANADA (FOSTER) (4)	BOARD (5)
1970	58.0	58.7	57.1	57.2	58.0
1971	59.6	60.6	58.8	58.9	59.7
1972	61.3	62.5	60.9	60.2	61.3
1973	63.0	64.4	63.0	61.3	63.0
1974	64.7	66.4	64.9	62.6	64.8
1975	67.0	68.4	65.8	63.9	67.1
1976	68.9	70.4	67.7	65.4	69.0
1977	70.8	72.4	70.0	66.8	70.9
1978	72.8	74.4	72.2	68.3	72.8
1979	74.7	76.4	74.5	70.0	74.8
1980	76.9	78.4	75.2	71.6	76.8
1981	78.9	80.4	77.7	73.5	78.7
1982	81.0	82.5	79.4	75.3	80.5
1983	83.0	84.5	81.0	77.2	82.3
1984	85.0	86.6	82.7	79.0	84.1
1985	87.2	88.7	82.7	80.8	86.1
1986	89.3	90.8	84.4	82.7	87.9
1987	91.4	93.0	86.0	84.7	89.7
1988	93.4	95.2	87.6	86.6	91.6
1989	95.4	97.5	89.2	88.6	93.4
1990	97.5	99.8	89.0	90.6	95.1
1991	99.5	102.1	90.6	92.5	96.9
1992	101.5	104.5	92.1	94.5	98.7
1993	103.5	107.0	93.6	96.3	100.4
1994	105.7	109.5	95.1	98.5	102.1
1995	107.8	112.1	94.6	100.5	103.4
1996	109.9	114.7	96.0	102.6	104.7
1997	112.1	117.3	97.4	104.6	106.0
1998	114.2	120.0	98.9	106.5	107.3
1999	116.4	122.8	100.2	108.4	108.5
30-YEAR REQUIREMENTS 1970 TO 1999	2,590	2,662	2,428	2,430	2,536
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.4	2.6	2.0	2.2	2.2

TABLE III-2

FORECASTS OF  
ALBERTA COMMERCIAL GAS REQUIREMENTS  
(BILLIONS OF CUBIC FEET)

<u>YEAR</u>	<u>BOARD STAFF</u> (1)	<u>COMBINED UTILITIES</u> (2)	<u>CONSOLIDATED (HEDLIN MENZIES)</u> (3)	<u>ALBERTA &amp; SOUTHERN AND TRANSCANADA (FOSTER)</u> (4)	<u>BOARD</u> (5)
1970	51.1	51.7	50.7	51.7	51.1
1971	52.9	54.5	52.2	54.0	52.8
1972	54.5	56.8	54.1	56.3	54.5
1973	56.3	59.2	55.9	58.6	56.3
1974	58.1	61.5	57.5	61.0	58.1
1975	60.4	63.7	60.8	63.3	60.5
1976	62.3	65.8	62.6	65.5	62.5
1977	64.3	68.0	64.7	67.7	64.5
1978	66.3	70.0	66.6	69.9	66.6
1979	68.3	72.0	68.8	72.0	68.7
1980	70.6	73.9	72.3	74.1	71.0
1981	72.7	75.9	74.6	76.4	73.2
1982	74.8	77.7	76.2	78.4	75.4
1983	77.0	79.7	77.8	80.6	77.6
1984	79.2	81.7	79.4	82.7	79.8
1985	81.4	83.7	82.7	84.9	82.2
1986	83.6	85.8	84.4	87.2	84.5
1987	85.9	87.9	86.1	89.5	86.9
1988	88.1	89.9	87.7	91.8	89.2
1989	90.3	92.0	89.3	94.3	91.5
1990	92.5	94.2	92.7	96.8	93.9
1991	94.8	96.5	94.3	99.3	96.3
1992	97.0	98.8	95.8	102.0	98.7
1993	99.2	101.1	97.4	104.7	101.1
1994	101.4	103.5	98.9	107.5	103.5
1995	103.5	105.9	102.4	110.4	105.4
1996	105.8	108.4	104.0	113.4	107.4
1997	108.0	110.9	105.6	116.4	109.4
1998	110.2	113.5	107.1	119.5	111.5
1999	112.5	116.1	108.6	122.8	113.5
30-YEAR REQUIREMENTS 1970 TO 1999	2,423	2,500	2,411	2,553	2,448
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.8	2.8	2.7	3.0	2.8

TABLE III-3

FORECASTS OF ALBERTA POPULATION

<u>YEAR</u>	<u>BOARD STAFF</u> (1)	<u>CONSOLIDATED</u> <u>(HEDLIN MENZIES)</u> (2)	<u>ALBERTA &amp; SOUTHERN</u> <u>AND TRANSCANADA</u> <u>(FOSTER)</u> (3)
1970	1,588,498	1,588,577	1,592,000
1971	1,620,940	1,616,486	1,624,000
1972	1,654,027	1,644,819	1,656,000
1973	1,688,309	1,673,710	1,689,000
1974	1,723,623	1,703,070	1,723,000
1975	1,760,587	1,732,978	1,759,000
1976	1,798,304	1,763,441	1,796,000
1977	1,836,859	1,794,406	1,834,000
1978	1,876,410	1,825,905	1,873,000
1979	1,916,914	1,857,822	1,913,000
1980	1,957,736	1,890,167	1,954,000
1981	1,999,334	1,922,828	1,997,000
1982	2,041,553	1,956,167	2,041,000
1983	2,084,336	1,990,077	2,086,000
1984	2,127,469	2,024,319	2,131,000
1985	2,170,755	2,058,709	2,177,000
1986	2,214,014	2,093,042	2,224,000
1987	2,257,111	2,127,142	2,272,000
1988	2,299,969	2,160,946	2,321,000
1989	2,342,536	2,194,313	2,371,000
1990	2,384,811	2,227,223	2,422,000
1991	2,426,822	2,259,692	2,474,000
1992	2,468,634	2,291,692	2,527,000
1993	2,510,321	2,323,332	2,581,000
1994	2,551,982	2,354,597	2,636,000
1995	2,593,711	2,385,585	2,693,000
1996	2,635,602	2,416,371	2,751,000
1997	2,677,744	2,446,968	2,810,000
1998	2,720,222	2,477,504	2,870,000
1999	2,763,106	2,507,936	2,932,000
AVERAGE ANNUAL GROWTH RATE 1970 TO 1999 (%)	1.9	1.6	2.1



#### IV INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS

This section examines the evidence of the interveners and presents the views of the Board on the two categories of Industrial and Contingent gas requirements, which are described in Informational Letter No. IL 70-2.<sup>(1)</sup> In total, Industrial and Contingent gas requirements are intended to embrace all the requirements of existing and future industrial concerns within the Province, other than the operating requirements of gas utility companies and permit-related gas requirements.<sup>(2)</sup> As stated in the Informational Letter, the Industrial gas requirements refer primarily to existing facilities and relatively firm plans to expand such facilities. The Informational Letter suggested that the requirements of new industrial concerns, which may be established in the Province over the forecast period, should be designated as Contingent gas requirements.

The majority of the interveners followed the guidelines outlined in the Informational Letter. The Board staff, the Combined Utilities and Alberta & Southern and TransCanada classified Industrial and Contingent gas requirements separately. However, there were some variations in the way in which these three

---

(1) The Informational Letter is reproduced in Appendix A.

(2) The operating requirements of gas utilities and permit-related gas requirements are discussed in Sections V and VI, respectively.

interveners presented their estimates. Unlike Alberta & Southern and TransCanada, both the Board staff and the Combined Utilities observed a distinction between Basic Industrial requirements, relating to small industrial users, and Special Industrial requirements relating to larger industrial users. Because of the importance of power generation, Alberta & Southern and TransCanada discussed the Industrial and Contingent gas requirements of electric utility companies separately from the requirements of other industrial concerns. Consolidated also gave separate consideration to the gas requirements of electric utility companies, but did not discuss its estimates in terms of Industrial and Contingent gas requirements. The City of Edmonton's submission was concerned principally with the gas requirements of the Edmonton Power plant.

In reviewing the evidence, the Board generally has followed the methods of presentation contained in the respective submissions. In some instances, the estimates of the interveners are not comparable in the form in which they were originally presented. Therefore, in the discussion of its own views, the Board has adjusted some of the estimates submitted by the interveners in order to permit a more complete comparison.

#### Views of the Board Staff

The Board staff submitted projections of Basic Industrial, Special Industrial and Contingent gas requirements. The staff's forecast of Special Industrial requirements was related to industrial concerns which consumed more than 100 million cubic

feet of gas in 1969. Special Industrial users were identified from actual consumption data reported to the staff. Historical data for Basic Industrial consumption were estimated as the difference between the total volume of historical gas sales at industrial rates and sales to Special Industrial users.

(1) Basic Industrial Requirements

For the Basic Industrial category, the Board staff projected requirements to grow at 3 per cent per year and to rise from a little over 13 billion cubic feet in 1970 to approximately 30 billion cubic feet in 1999. Over the 30-year forecast period, the staff's projection of Basic Industrial requirements, which is shown in column (1) of Table IV-1, totalled 608 billion cubic feet.

The Board staff noted that, in the normal course of expansion, a number of companies in the Basic Industrial group could be expected to be reclassified as Special Industrial users. The staff's forecast did not attempt to take account of the impact of future reclassifications and therefore assumed that the composition of the Basic Industrial group would remain unchanged. The staff stated that in the period 1965 to 1969, the annual requirements of all the users in the Basic Industrial group, at the beginning of the period, had grown at approximately the same percentage rate as the projected requirements.

(2) Special Industrial Requirements

According to the Board staff's estimates, there were 39 companies classified as Special Industrial users in 1969. For

purposes of projection, the staff included in the Special Industrial category one additional company, which commenced operations in 1970. In order to forecast the requirements of these users, the staff requested each of the companies to supply estimates of future gas requirements, with supporting data, for the period 1970 to 1979. Requirements beyond 1979 were projected on the basis of trends in the first ten years of the forecast and advice received from the companies concerned. The staff modified growth patterns over the later period whenever it appeared that further increases would necessitate large scale expansions of facilities for which firm plans had not been laid.

Column (2) of Table IV-1 presents the Board staff's forecast of Special Industrial requirements. On the basis of information received from the companies, and its own judgment, the staff predicted that Special Industrial requirements would increase by 174 billion cubic feet from the 1970 estimate of 115 billion cubic to 289 billion cubic feet in 1999. Over the 30-year forecast period the requirements were expected to total 6,392 billion cubic feet. The staff observed that the requirements projected for 1979 were some 77 billion cubic feet greater than the 1970 level, and that the annual growth in requirements had been reduced over the remaining 20 years of the forecast to reflect the capacity limitations of various plants and the fact that expansion plans generally had not been formulated for the later period.

In the Board staff's submission, the forecast of Special Industrial requirements was examined in terms of six major groups



of industries, classified by type of product. The industry groupings employed by the staff, and the 30-year gas requirements projected for each group, were as follows: Oil Products, 386 billion cubic feet; Fertilizers, 837 billion cubic feet; Chemicals, Metallurgical and Allied Products, 1,890 billion cubic feet; Construction Materials, 309 billion cubic feet; Other Products, 538 billion cubic feet; Electric Power, 2,430 billion cubic feet.

Within the Oil Products group, only modest increases were projected by the staff for the gas requirements of oil refineries, while the requirements of the Great Canadian Oil Sands plant were forecast to remain constant at approximately the 1969 level. Based on the anticipated expansion of existing plants, annual requirements in the Fertilizer group were expected to be approximately double the 1969 level in 1979, but only marginal increases were predicted thereafter. The requirements of the Chemicals group, which were related to expanding market opportunities for the group's products, were expected to exhibit steady growth over the entire forecast period. Gas requirements in the Construction group also were expected to increase steadily, at approximately the same percentage rate as the growth in population. The growth of requirements in the Other Products group was based mainly on the expansion of the existing pulp mill at Hinton and the introduction of a new coal mining operation at Grande Cache.

The most substantial increases in requirements identified by the Board staff related to gas used for power generation. In its submission, the staff anticipated that the gas requirements

of Calgary Power would be virtually eliminated as a result of conversion from gas to coal units. Since the staff had been informed that Calgary Power would supply increasing amounts of power to Lethbridge over the forecast period, a decline also was projected in the gas requirements of the City of Lethbridge power plant. Modest increases were projected up to 1979 for the Medicine Hat Power Plant, associated with a plant expansion in 1975, whereas the requirements of Canadian Utilities and Northland Utilities were expected to behave in an erratic pattern. The major factor in the growth of gas requirements for power generation was the anticipated expansion in the requirements of the Edmonton Power Plant. The combined requirements of all other systems were forecast to decline from some 18 billion cubic feet in 1969 to 15 billion cubic feet in 1979 and to remain constant at this level up to 1999. By contrast, Edmonton Power's requirements, which were estimated at 20 billion cubic feet in 1969, were expected to increase to 56 billion cubic feet in 1979 and to reach a level of 103 billion cubic feet by 1999.

At the hearing, Mr. Rimell, a witness for the Board staff, stated that the staff's forecast for Edmonton Power had been based on a schedule of gas requirements for the period 1970 to 1979 provided by the City of Edmonton in a letter dated February 4, 1970. The staff observed that the City of Edmonton had submitted at the hearing a new projection of gas requirements for the period 1970 to 1979 which was somewhat lower than the original schedule. On the basis of the new material submitted by the City of Edmonton,

the staff estimated that the Special Industrial gas requirements for power generation throughout the Province would total 2,140 billion cubic feet over the period 1970 to 1999, as compared to the staff's original estimate of 2,430 billion cubic feet.

In the course of questioning, the Board staff was asked whether it believed substantial increases in gas requirements for power generation to be realistic in view of evidence contained in Alberta & Southern and TransCanada's submission which suggested that coal was a significantly cheaper fuel than gas. The staff said that the coal price quoted in the latter submission appeared to relate to the mine mouth, whereas the price quoted for gas was an average delivered price and therefore might not be comparable. The staff also believed the economics of coal-fired versus gas-fired stations to be less clear-cut than indicated by a comparison between the prices of the respective fuels. In this connection, the staff referred to a statement in the City of Edmonton's submission to the effect that the capital cost of gas stations was approximately two-thirds the cost of coal stations. The staff disclaimed any special knowledge in this area and stated that it wished to be guided by expert advice from both the City of Edmonton and other interveners.

### (3) Total Industrial Requirements

The Board staff's estimates of Basic Industrial and Special Industrial gas requirements have been summed in column (3) of Table IV-1. As shown in the Table, the total Industrial requirements rise from 127 billion cubic feet in 1970 to 208 billion

cubic feet in 1979 and reach a level of 319 billion cubic feet by 1999. The annual requirements result in 30-year requirements of 6,999 billion cubic feet.

(4) Contingent Requirements

As shown in column (4) of Table IV-1, the Board staff provided a Contingency Allowance amounting in total to 1,848 billion cubic feet over the 30-year forecast period, commencing at a level of some 2 billion cubic feet in 1971 and increasing to 105 billion cubic feet in 1999. The staff pointed out that the volumes in the Contingency Allowance, similarly to Special Industrial requirements, were associated with large industrial users. The staff believed the additional volumes in the Contingency Allowance to be necessary, firstly, to accommodate the requirements of new industrial users and, secondly, because the long term growth prospects for some industries indicated the need to expand capacity over and above the levels assumed in the forecast of Special Industrial requirements.

The Board staff referred to a number of new industrial projects which had reached various stages of planning. It was anticipated that gas would be used for coal drying at a second mining venture in the Grande Cache area and that gas also would be required for the operation of a new sulphate plant near Metiskow. The staff noted that three new pulp mills were under consideration in the Province, and recommended that an allowance amounting in total to 227 billion cubic feet should be set aside for the establishment of two such mills over the forecast period.



In addition, the staff made allowance for the further development of the oil sands, commencing with the inception of production from the Syncrude Canada Ltd. (Syncrude) plant in mid-1976 and based thereafter on the establishment of one new plant every five years. The staff believed this scale of development to be realistic in view of the anticipated decline in the life index of Alberta's conventional crude oil reserves. However, because of the remoteness of large proved gas reserves, the staff assumed that the gas requirements of the Syncrude plant would be phased out entirely at the end of the sixth year of operation and that the requirements of subsequent plants would follow a similar pattern. The combined requirements of the new oil sand plants included in the staff's Contingency Allowance totalled 235 billion cubic feet over the forecast period.

The remaining industrial project considered by the Board staff was the proposed iron-ore processing plant of Peace River Mining & Smelting Ltd. (Peace River). The staff recalled that this project had been subject to a number of postponements in the past. On the basis of information received from Peace River, the staff stated that a further postponement in the start-up date, from 1973 to 1975, now appeared likely. The staff noted that a decision to proceed with the scheme was partly dependent on the outcome of feasibility studies at Peace River's Ontario plant, which had recently been constructed but was still in process of being tested. The staff stated that the Alberta project was dependent also on an improvement in iron powder markets, which currently

were in a state of excess supply. According to the staff's estimates, Peace River's original schedule of production, adjusted to a start-up date in 1975, would result in total gas requirements of some 2,000 billion cubic feet over the term of the forecast. The staff was doubtful whether production would actually commence in 1975 and, because of the uncertainties, recommended that total requirements of only 500 billion cubic feet be allocated to the Peace River project.

In addition to the gas requirements of new industrial projects, the Board staff believed that provision should be made in the Contingency Allowance for increases in the requirements of some existing industrial concerns, over and above the volumes included in the forecast of Special Industrial requirements. The staff anticipated that an expansion in the Great Canadian Oil Sands plant in 1972, and minor increases in the gas requirements of the Chemicals and Other Products groups, would result in additional requirements totalling 258 billion cubic feet over the forecast period. Additional requirements totalling 88 and 225 billion cubic feet were assessed for oil refineries and fertilizer plants, respectively. Finally, the Board staff recommended that volumes totalling 245 billion cubic feet should be included in the Contingency Allowance to cover possible increases in the gas requirements of electric utility companies. During the early years of the forecast, the staff related the Contingent volumes for power generation to emergency loads at Calgary Power's one remaining gas unit at Wabamun, as well as variable operating

requirements on other systems. During the later years of the forecast, the Contingent volumes were based on the anticipated growth of electricity consumption associated with industrial developments in the northern part of the Province.

(5) Total Industrial and Contingent Requirements

The Board staff's forecast of Basic Industrial, Special Industrial and Contingent gas requirements is shown in column (5) of Table IV-1. The combined requirements of the three categories, which were estimated at 127 billion cubic feet in 1970, were projected to increase to 424 billion cubic feet in 1999 and to total 8,847 billion cubic feet over the 30-year forecast period.

At the hearing, the staff was asked to comment on the possibility that the estimates of future gas requirements obtained from the survey of large industrial users might contain an upward bias. The staff expressed the view that, in total, the survey had not overestimated requirements. The staff found support for this opinion in the fact that most of the difference between the forecasts of the interveners could be traced to different assumptions regarding the future requirements of two users, the Edmonton Power plant and Peace River.

Views of the Combined Utilities

The Combined Utilities submitted estimates of Basic Industrial, Special Industrial and Contingent gas requirements. In preparing these estimates, the Combined Utilities followed the same general procedures used in an earlier submission filed with the Board in 1966.

(1) Basic Industrial Requirements

The forecast of Basic Industrial requirements was the result of separate projections performed for the Combined Utilities' service areas and the remainder of the Province. For the service areas of the Combined Utilities, Basic Industrial requirements were forecast on the basis of population growth and estimated rates of per capita consumption. A constant per capita rate of 10 thousand cubic feet was employed throughout the forecast and, hence, the growth of Basic Industrial requirements within the service areas was expected to parallel population growth.<sup>(3)</sup> For the remainder of the Province, Basic Industrial requirements were projected to grow at a constant rate of 2 per cent per year. The requirements for the Province as a whole are shown in column (1) of Table IV-2. These requirements were estimated at 13 billion cubic feet in 1970 and were expected to increase to 27 billion cubic feet in 1999, totalling 583 billion cubic feet over the forecast period.

(2) Special Industrial Requirements

In their submission, the Combined Utilities segregated the requirements of Edmonton Power from the requirements of other large industrial users. The respective estimates are shown in columns (3) and (2) of Table IV-2.

The combined Utilities generally did not discuss the growth in gas requirements of particular industries or industry groups.

---

(3) The Combined Utilities' forecast of population for their own service areas is discussed in Section III.



An exception was made in the case of Edmonton Power because of the large potential growth in the requirements of this user. As shown in column (3) of Table IV-2, the Combined Utilities adopted the schedule of gas requirements submitted by the City of Edmonton for the Rosssdale and Clover Bar generating stations. However, both in their submission and at the hearing, the Combined Utilities expressed a number of reservations about the use of this schedule. It was noted that the Rosssdale and Clover Bar stations were expected to reach the limit of their capacities in 1979 and consequently the schedule made no provision for any growth in Edmonton Power's gas requirements beyond this date. This treatment was followed largely because Edmonton Power had yet to make a decision on the type of fuel to be used in new generating stations in 1980 and subsequent years, and there appeared to be no firm plans at the present time to use gas. The Combined Utilities recommended that the Board should resolve the matter of additional gas requirements for Edmonton Power on the basis of evidence submitted by the City of Edmonton. While disclaiming any special knowledge of the situation, the Combined Utilities believed that it would be preferable for the Board to err on the side of safety in determining Edmonton Power's future gas requirements.

Apart from Edmonton Power, the Combined Utilities considered 42 Special Industrial loads, 24 within their own service areas and 18 in other parts of the Province. These loads were selected partly on the basis of conversations held with the Board staff

prior to the hearing. The Combined Utilities conducted interviews with each of the consumers in the survey in order to arrive at the forecast of requirements shown in column (2) of Table IV-2. The Combined Utilities stated that they had followed the advice of the individual consumers unless the prospective growth in requirements appeared to necessitate plant additions for which definite plans had not been formulated. As a result of this procedure, the 42 Special Industrial loads were forecast to increase from some 95 billion cubic feet in 1970 to 132 billion cubic feet in 1979. With the exception of a small decrease in one of the loads between 1980 and 1985, no changes were projected in the requirements over the last 20 years of the forecast. The Combined Utilities assessed 30-year requirements for these loads at 3,768 billion cubic feet.

In column (4) of Table IV-2, the estimates for Edmonton Power have been added to the forecast for the remaining 42 Special Industrial loads. Considered in this way, the requirements increase from 118 billion cubic feet in 1970 to 179 billion cubic feet in 1979 and, apart from a small decline between 1980 and 1985, remain constant for the remainder of the forecast. The resultant estimate of 30-year requirements is 5,040 billion cubic feet.

### (3) Total Industrial Requirements

Total Industrial gas requirements, comprising Basic and Special Industrial requirements, are shown in column (5) of Table IV-2. The requirements reach 196 billion cubic feet in

1979, as compared to an estimated level of 131 billion cubic feet in 1970, and rise to some 205 billion cubic feet by 1999. Over the 30-year period total Industrial gas requirements amount to 5,623 billion cubic feet.

(4) Contingent Requirements

The Combined Utilities contended that the forecast of Special Industrial requirements was almost certain to underestimate the actual requirements of large industrial users over the forecast period. This feature was attributed to the fact that new industrial loads had been excluded from the Special Industrial forecast and also to the fact that the projected growth of existing loads reflected only those additions to capacity for which there were firm plans at the present time. Provision for further growth was considered necessary on both accounts. The additional volumes were appraised by the Combined Utilities both before and after allowing for the possible requirements of Peace River.

Prior to considering the question of the Peace River scheme, Contingent gas requirements were assessed at 1,859 billion cubic feet over the forecast period. As shown in column (6) of Table IV-2, the need for these additional volumes was expected to commence at 4 billion cubic feet in 1972 and to increase by 4 billion cubic feet each year until a level of 36 billion cubic feet was reached in 1980. The annual requirements were projected to increase by 5 billion cubic feet annually over the next 10-year period and by 6 billion cubic feet annually after 1990, resulting in annual requirements of 140 billion cubic feet in

1999.

The suggested requirements were based partly on the previous forecast submitted by the Combined Utilities in 1966. The previous forecast had provided for a cumulative increase of 4 billion cubic feet in Contingent gas requirements, and the Combined Utilities stated that the additional volumes had been required by the Canadian Western and Northwestern systems in 1968 and 1969. In the current forecast, the Contingent gas requirements shown for the years 1972 to 1980 were the same as the levels occurring four years earlier in the previous forecast. These levels were believed to be appropriate in view of the more substantial growth now predicted for Special Industrial requirements in the period 1970 to 1980. Beyond 1980, somewhat larger increases were projected in Contingent gas requirements, based on an examination of Basic Industrial, Special Industrial and Contingent gas requirements in relation to Residential and Commercial requirements. The Combined Utilities stated that, if the requirements of Edmonton Power and Peace River were excluded from the calculation, the share of the Industrial and Contingent components in the total increased from 49.4 per cent in 1970 to 54.9 per cent in 1980. The larger increases in Contingent gas requirements after 1980 were judged necessary in order to prevent a decline in the share of the combined Industrial and Contingent components.

Because of the method used to develop the estimates of Contingent gas requirements shown in column (6) of Table IV-2, the Combined Utilities did not relate these requirements to



specific industrial projects. However, the Combined Utilities affirmed that the estimates were not intended to provide for any growth in Edmonton Power's gas requirements after 1979. At the hearing, witnesses for the Combined Utilities expressed sympathy with Edmonton Power's position. The witnesses believed that it was important for the Board to decide whether Edmonton Power's projections of electricity consumption were reasonable. If that were found to be the case, the witnesses recommended that the Board should include a provision in the Contingency Allowance for the use of gas in new generating stations over the last 20 years of the forecast.

It was left to the Board's discretion as to whether or not any further provision should be made for the requirements which might arise from Peace River's iron ore processing plant. As shown in column (7) of Table IV-2, the Combined Utilities presented estimates for this project totalling 1,812 billion cubic feet over the forecast period. The Combined Utilities obtained these estimates by adjusting the numbers used in their 1966 submission to reflect Peace River's advice that the initial year of production from the scheme had been set back to 1976. At the hearing, a witness for the Combined Utilities stated that an allowance had been shown for Peace River mainly because a similar procedure had been followed in the 1966 submission. The witness added that the Combined Utilities had expected Peace River to submit evidence at the hearing, but no representation had actually been made.

In column (8) of Table IV-2, the estimates presented by the Combined Utilities for Peace River have been added to the forecast of Contingent gas requirements shown in column (6) of the Table. Stated in this way, the requirements commence at a level of 4 billion cubic feet in 1972, rise to some 49 billion cubic feet in 1979 and reach 282 billion cubic feet by 1999. The resultant 30-year requirements amount to 3,671 billion cubic feet.

(5) Total Industrial and Contingent Requirements

The total Industrial and Contingent gas requirements estimated by the Combined Utilities are shown in column (9) of Table IV-2. The annual requirements rise from 131 billion cubic feet in 1970 to 244 billion cubic feet in 1979 and increase to some 487 billion cubic feet in the terminal year of the forecast. Over the 30-year period, these requirements amount to 9,294 billion cubic feet.

Views of Alberta & Southern and TransCanada

Alberta & Southern and TransCanada made a joint submission which was prepared by Foster Economic Consultants Ltd. (Foster). The submission contained separate forecasts of Industrial and Contingent gas requirements, defined according to the terms suggested in the Informational Letter. Special consideration was given to gas requirements for power generation, which were discussed on an overall basis, prior to showing the volumes allocated to Industrial and Contingent gas requirements. The Board has reviewed the evidence respecting gas requirements for power generation in a similar manner.

The forecasts for the various components of Industrial and Contingent gas requirements were based mainly on a customer survey. To provide a check on some of the components, statistical analysis was also used. In addition, the natural gas forecasts were examined in relation to forecasts for other types of fuel. In summarizing Alberta & Southern and TransCanada's submission, reference has been made in this section to Foster's evidence on other fuels, which is presented in more detail in Appendix C. Reference has also been made to the conclusions reached by Foster on the basis of statistical analysis.

(1) Industrial and Contingent Requirements for  
Power Generation<sup>(4)</sup>

Foster noted that the historical growth in the use of gas for power generation had been substantial, averaging 8.6 per cent annually between 1955 and 1969. It was Foster's opinion that the annual growth in gas requirements for power generation would moderate to 5.3 per cent in the period 1970 to 1979, and slow to 4.4 per cent in the following ten-year period. As shown in column (3) of Table IV-3, requirements of 66 and 101 billion cubic feet were forecast in 1979 and 1989, respectively. The requirements were expected to decline during the final ten years of the forecast period and to be some 88 billion cubic feet in 1999. On this basis, Foster estimated total 30-year gas requirements for power generation at 2,258 billion cubic feet. The volumes allocated to Industrial gas requirements are shown in

---

(4) Foster's estimates of Industrial and Contingent gas requirements for power generation related solely to the requirements of electric utility companies and excluded volumes of gas required to generate electricity in industrial plants.

column (1) of Table IV-3. Column (2) of the Table shows the Contingent portion of gas requirements for power generation.

The growth rates in the use of gas for power generation were considerably lower than the growth rates which Foster predicted for electricity consumption. For the Province as a whole, Foster employed an average annual growth rate for electricity consumption of 9 per cent in the period 1970 to 1980, declining to 8 per cent in the period 1981 to 1989 and 7 per cent in the final ten years of the forecast. Foster believed these growth rates to be realistic, having regard for the projections of various electric utility companies and the National Energy Board (NEB), as well as the growth patterns of electricity consumption in the United States. The more modest growth rates in the use of gas as a fuel for power generation reflected Foster's opinion that coal, rather than natural gas, would supply the majority of the incremental fuel requirements. As a result of this assessment, Foster predicted that coal used for power generation would grow at an average annual rate of some 10 per cent over the 30-year forecast.

Foster stated that the conclusions reached in the submission were in close agreement with the plans of the majority of electric utilities in the Province. Reference was made to the fact that gas requirements would be reduced at the City of Lethbridge power plant because greater reliance was to be placed in future on electricity supplied by Calgary Power. The fuel requirements of Calgary Power were expected to be met almost entirely from coal and, therefore, a substantial decline was anticipated in the



volumes of gas required by this utility. Canadian Utilities and Northland Utilities also were expected to depend more heavily on coal. After initial reductions, the gas requirements of these utility companies were forecast to show some increase in later years, due to the displacement of fuel oil by natural gas.

Sustained growth in gas requirements for power generation was forecast for only two utilities, the City of Medicine Hat and Edmonton Power. The growth in the City of Medicine Hat's requirements was expected to continue, at moderate rates, throughout the forecast. Very substantial increases, averaging some 9 per cent annually, were predicted for the gas requirements of Edmonton Power until the end of 1980. These requirements were expected to reach 54 billion cubic feet in 1980, as compared to the 1969 level of some 21 billion cubic feet, and to be the major factor outweighing declines in other areas during the period. In the period 1981 to 1989, the average annual growth rate for Edmonton Power's gas requirements was reduced to approximately 4 per cent. A declining trend was adopted for Edmonton Power's requirements in the final years of the forecast.

The estimates of Edmonton Power's gas requirements in the period up to 1980 were based on a forecast which was supplied to Foster by Edmonton Power. Foster accepted Edmonton Power's view that the existing Rossdale station would continue to operate at capacity during this period and that the fuel requirements of the new Clover Bar station would be supplied by natural gas. The resultant growth in gas requirements was judged reasonable in relation to

future levels of electricity consumption. However, Foster believed the projection of Edmonton Power's gas requirements at an average annual growth rate in the order of 9 per cent to be unrealistic after 1980, having regard for trends in electricity consumption and the fact that coal was likely to become increasingly competitive during the later period. Accordingly, the annual growth in Edmonton Power's fuel requirements was scaled down to 8 per cent between 1981 and 1989. A 4 per cent average annual growth rate was applied to Edmonton Power's natural gas requirements in the period 1981 to 1989, because Foster believed there was an equal likelihood of the incremental fuel requirements being supplied by coal or natural gas. In 1990 and subsequent years, it was assumed that all the incremental fuel requirements of Edmonton Power would be supplied by coal. The decline in Edmonton Power's gas requirements during this period was based on the belief that some gas-fired equipment at the Rosssdale station would be taken out of service.

The treatment of Edmonton Power's gas requirements after 1980 reflected Foster's assessment of the comparative advantages of using coal and natural gas. The submission provided estimates of the existing price spread between the two fuels. A price of 18 cents per thousand cubic feet was considered representative of the cost of natural gas for large industrial users. By contrast, the average cost of coal at the mine mouth was estimated at 7 cents per thousand cubic feet of natural gas equivalent. It was acknowledged that the cost of coal would be higher for a power station

which was located away from the mine site. Conversely, higher transmission costs would be incurred if the power station were to be located at the mine site. However, more efficient transportation methods, and the advent of low cost transmission facilities, were expected to favour the use of coal in the future.

Foster recognized that it was difficult to make an accurate forecast of fuel prices. However, in Foster's opinion, there were good grounds for believing that coal prices would remain stable over the forecast period, the most important being the development of new strip mines and further improvements in mining technology. In these circumstances, Foster anticipated that the price spread between gas and coal would widen. Foster calculated that by 1980, escalation clauses in existing gas purchase contracts would result in increases of 2 or more cents over the current price for natural gas. Foster expressed the opinion that, although Edmonton Power was committed to a gas-fired expansion program in the 1970's, the decision not to build a coal-fired plant at Genesee during this period had been a relatively close one. Therefore, in view of trends in the prices of coal and natural gas, Foster believed that the expansion program in the 1980's was equally likely to be based on either of these two fuels. Further increases were anticipated in natural gas prices during this period and, by 1990, Foster believed coal would have established a clear competitive advantage.

At the hearing, Foster was asked to comment on differences

between the estimates of Edmonton Power's gas requirements in Alberta & Southern and TransCanada's submission and the estimates presented by the City of Edmonton. Foster noted that the City had estimated Edmonton Power's gas requirements on the assumption that all additions to capacity after 1980 would be based on natural gas. For this reason, Foster regarded the City's estimates as representing the maximum case for Edmonton Power's gas requirements. It was understandable, in Foster's opinion, that the City should wish to safeguard gas supplies for the duration of the forecast, so long as there were doubts about the choice of fuels after 1980. Foster, on the other hand, had attempted to estimate the likelihood of using gas or coal in new generating stations after 1980. From the point of view of forecasting actual requirements, Foster believed this method would yield more accurate results.

Foster drew attention to a number of factors, other than price, which would affect the choice between natural gas and coal. Among the considerations referred to in the submission were the initial investment costs, pollution abatement costs and the assurance of long term supply. Foster did not make a detailed study of the various aspects of fuel selection, but attempted a general appraisal of both pollution levels and the availability of long term supplies. Because of the low sulphur content of sub-bituminous coal in Alberta Foster submitted that coal and natural gas were equally acceptable as fuels for power generation. Without retracting this opinion, the witness for Foster agreed with the view expressed at the



hearing that pollution was a more serious problem in cities like Edmonton than was the case in less populated areas. Foster stated that approximately 600 million tons of coal would be required for power generation as a result of the assumptions employed in the forecast. Out of the total provincial coal reserves of 24 billion tons, Foster estimated that 1.5 billion tons of sub-bituminous reserves would be economically recoverable during the next 30 years. It was Foster's belief that additional supplies would become available in the form of by-products from coking coal operations undertaken in response to expanding export markets in Japan. While recognizing that the sulphur content of these additional supplies might be somewhat higher, Foster considered the by-products to be suitable for power generation. From the standpoint of both pollution and availability, therefore, Foster believed that coal would achieve the dominance shown in the forecast.

The witness for Foster was asked to elaborate on the fact that, whereas the total energy requirements predicted by Foster were similar to earlier estimates by the NEB, the volumes of gas required for power generation in Foster's forecast were only 100 billion cubic feet in 1990, as compared to the National Energy Board's projection of 206 billion cubic feet. Foster stated that the NEB numbers were based on the assumption that natural gas, coal and fuel oil would supply respectively 62, 36 and 2 per cent of fuel requirements for power generation in 1990. Foster placed more confidence in its own numbers, which reflected the intentions of various electric utility companies in the Province. Foster emphasized that the majority of electric utility companies planned

to use gas in existing facilities only. It was Foster's opinion that the impact of variations between actual and forecast levels of electricity consumption would be confined largely to the coal portion of fuel requirements. Foster believed that, with the exception of Edmonton Power's gas requirements, the natural gas forecast contained relatively firm numbers.

(2) Industrial and Contingent Requirements  
Excluding Power Generation<sup>(5)</sup>

Industrial concerns other than electric utilities were referred to by Foster as general industrial users. Among the general industrial users in the Province, Foster contacted the operators of 22 large plants which were using natural gas as a raw material or fuel in 1969. The survey encompassed 7 oil refineries, 5 fertilizer plants, 5 petrochemical plants and 5 plants producing miscellaneous products. The gas requirements of all existing general industrial users were forecast on the assumption that the 22 plants would account for 78 per cent of the requirements, similar to the percentage in 1969.

Column (4) of Table IV-3 shows Foster's forecast of Industrial gas requirements for the existing general users. In preparing the forecast, Foster modified the estimates of some of the consumers in the survey whenever the projected growth in gas requirements appeared to exceed current or planned capacity. On this basis, the Industrial gas requirements of general users were forecast to rise

---

(5) The estimates prepared by Foster included volumes of gas required to generate power in industrial plants.

from some 91 billion cubic feet in 1970 to some 123 billion cubic feet in 1979 and to reach a level of 127 billion cubic feet in 1999. The 30-year Industrial gas requirements of general users were assessed at 3,574 billion cubic feet.

The forecast of Contingent gas requirements in column (5) of Table IV-3 contains a provision for additional growth in the gas requirements of established general industrial users. The estimates also reflect an allowance for the gas requirements of new users during the forecast period. As shown in column (5) of the Table, the Contingent gas requirements were estimated to commence at a level of some 1 billion cubic feet in 1970 and rise to some 165 billion cubic feet by 1999, totalling 2,055 billion cubic feet over the 30-year period. Because of the confidential nature of some of the information received from customers, Foster did not disclose the requirements allocated to specific industrial projects. However, Foster offered several examples of the kind of industrial developments underlying the forecast of Contingent gas requirements. These included expansions in the pulp and paper industry, expansions of petrochemical and fertilizer plants, increased production from the Great Canadian Oil Sands plant, the use of gas for coal drying at several new mines, the establishment of the Syncrude plant in 1976 and further exploitation of the oil sands in the early 1980's. Foster stated that the gas requirements associated with such developments had been reduced in some instances in recognition of the uncertainties which were involved. Thus, Syncrude's requirements were estimated at 75 per cent of the gas requirements for a plant with similar characteristics. Further details of the application

of this method were supplied to the Board after the hearing. Foster believed Peace River's proposed iron ore processing plant to be particularly uncertain, in view of the scheme's long history of postponement. For this reason, Foster made no allowance for the Peace River project.

Column (6) of Table IV-3 shows, in total, the volumes estimated by Foster for the Industrial and Contingent gas requirements of general users. The combined requirements were estimated to rise from some 92 billion cubic feet in 1970 to a level of 156 billion cubic feet in 1979 and to reach 293 billion cubic feet by 1999. Over the 30-year period, the combined Industrial and Contingent gas requirements of general users amount to 5,629 billion cubic feet.

Foster said that the results obtained from the customer survey provided a good indication of the combined Industrial and Contingent gas requirements of general users. In this connection, Foster referred to a projection derived from a linear equation relating these gas requirements to a constant dollar series for value-added in the Province's manufacturing industries. On the basis of a projected annual growth rate of 3.7 per cent in the value-added series, the equation, which was estimated from historical data, yielded a prediction of 265 billion cubic feet for the combined Industrial and Contingent gas requirements of the general users in 1999. Foster claimed the latter estimate to be a reasonable, if somewhat conservative, confirmation of the growth suggested by the customer survey.



### (3) Total Industrial and Contingent Requirements

The total Industrial and Contingent gas requirements estimated by Foster for electric utilities and general users are shown in column (9) of Table IV-3. These requirements, which were estimated to be some 127 billion cubic feet in 1970, were projected at 222 and 381 billion cubic feet in 1979 and 1999, respectively. Foster emphasized that one of the most important factors affecting the growth in gas requirements was the expansion anticipated in the use of coal for power generation. Foster placed more reliance on the estimates for the first ten years of the forecast than the estimates over the remainder of the period. However, Foster expressed the opinion that the forecasts contained in all the submissions were in reasonably close agreement, except for the estimates of gas requirements relating to Edmonton Power and Peace River. As discussed in Appendix C, Foster's natural gas forecasts were related to forecasts for other forms of energy. Foster stated that the resultant levels of total energy requirements corresponded closely to a previous forecast by the NEB. From this comparison, Foster concluded that its own forecasts for natural gas were realistic projections.

#### Views of Consolidated

In the study prepared for Consolidated by Hedlin Menzies & Associated Ltd. (Hedlin Menzies), natural gas requirements were considered in the context of requirements for all types of energy. As discussed more fully in Appendix C of this report, total energy requirements were examined on an historical basis by aggregating

the separate demands for electricity, natural gas and other fossil fuels. To avoid duplication, the historical numbers for natural gas and other fossil fuels were stated net of requirements for power generation. The projections of energy requirements employed similar definitions. Consequently, Hedlin Menzies' forecast of natural gas requirements in the industrial sector excluded inputs of natural gas for power generation. These inputs were assessed by Hedlin Menzies outside the framework of the energy forecast, after taking into consideration the projected growth of electricity consumption in both the industrial and the residential and commercial sectors. The estimates of gas requirements for the industrial sector and for power generation were not discussed in terms of the Board's definitions of Industrial and Contingent requirements. However, in total, the two sets of estimates presented by Hedlin Menzies were intended to embrace all the categories of use included in the Board's definitions.

(1) Industrial Sector

Appendix C contains a detailed presentation of Hedlin Menzies' projections for all types of energy in the industrial sector. As shown in Table C-2 of the appendix, total energy requirements in the industrial sector were forecast to increase from the equivalent of 120 trillion Btu's in 1970 to the equivalent of 536 trillion Btu's in 1999. The volumes supplied by each type of energy were projected by estimating proportionate shares in total energy requirements. While the proportionate share of natural gas was expected to decline modestly from some 79 per cent in 1970 to approximately 75 per cent in 1999, substantial growth was

predicted in absolute terms. Thus, as shown in column (1) of Table IV-4, requirements for natural gas in the industrial sector were estimated to increase from 94 billion cubic feet in 1970 to 402 billion cubic feet in 1999. In total, natural gas requirements in the industrial sector were estimated at 6,460 billion cubic feet over the 30-year forecast period.

Hedlin Menzies stated that the proportionate shares assigned to natural gas and other forms of energy were based partly on conversations with industry and government organizations in Alberta, supplemented by an independent analysis of relative prices. The submission referred to discussions with several large industrial concerns, as well as the Alberta Bureau of Statistics, the Alberta Research Council and members of the Board staff. These investigations indicated that natural gas would remain the predominant source of industrial energy over the forecast period, but that electricity would play an increasingly important role in the industrial sector. A decline was projected in the proportionate share of natural gas, primarily to accommodate a 7 per cent annual growth rate in electricity consumption. The anticipated decline in the natural gas share was supported by references to the historical declines which had taken place since the late 1950's and early 1960's. Witnesses from Hedlin Menzies acknowledged that there might be uncertainties about the extent of future declines. However, any reversal of the historical trends was considered extremely unlikely. The witnesses said that, at the levels of total energy requirements forecast for the industrial sector, the principal result of

assigning a larger share to natural gas would be to reduce the growth of electricity consumption. The projected annual growth of 7 per cent in electricity consumption was based on recent trends in the prices of electricity and natural gas, and on the assumption that the prices for both types of energy would be determined by market forces in the future. The witnesses pointed out that the electricity forecast in Consolidated's submission was conservative in relation to the forecasts of some electric utilities.

The witnesses from Hedlin Menzies were questioned about the assumptions underlying the forecast of total energy requirements in the industrial sector. Hedlin Menzies believed that the constant dollar series for value-added in mining, manufacturing and forestry provided the best indicator of changes in total energy requirements in the industrial sector. As described in Appendix C, historical data for Alberta were used to estimate a linear relation between the two series. This statistical relation was employed, in conjunction with a forecast for value-added, to determine future levels of total energy requirements in the industrial sector.

Hedlin Menzies projected real value-added in mining, manufacturing and forestry at a constant annual growth rate of 5 per cent over the forecast period. It was noted that this measure of industrial activity had exhibited somewhat faster growth in the period 1950 to 1969. However, Hedlin Menzies observed that this growth had not been matched by other segments of the economy.



Moreover, the growth in real value-added for the selected industries had slowed to an average annual rate of 5.8 per cent during the last five years, mainly because of the greater maturity of the oil and gas industry. Both for this reason, and because of the growing importance of service industries, an annual growth rate of 5 per cent had been forecast for real value-added in mining, manufacturing and forestry, similar to the growth forecast for Gross Provincial Product.

The witnesses were asked to consider a number of specific industrial developments and to assess the impact of these developments, firstly, on the forecast of value-added and secondly, on the forecast of energy requirements in the industrial sector. The witnesses stated that the timing of industrial developments was difficult to predict and, hence, the forecasts of both real value-added and industrial energy requirements might turn out to be underestimates or overestimates in particular years. Explicit consideration had not been given to the possibility of a relaxation in United States' controls on imports of Canadian oil. However, the witnesses said that they had taken an optimistic approach towards the overall level of industrial activity in Alberta. Over the long term, the forecast of industrial activity was intended to reflect favourable policy changes, as well as the impact of major new industrial projects similar to the Peace River iron ore processing plant. In the opinion of the witnesses, one or more projects of this magnitude would be required over the forecast in order to sustain a 5 per cent annual growth in real value-added.

The related energy requirements were considered by Hedlin Menzies to be realistic over the forecast period as a whole, provided that new industries locating in Alberta required approximately the same inputs of energy per unit of output as existing industries.

(2) Power Generation<sup>(6)</sup>

Hedlin Menzies estimated the volumes of gas used for power generation to be some 38 billion cubic feet in 1969. The annual gas requirements associated with existing generating capacity were assumed to remain constant at the 1969 level throughout the forecast period. Hedlin Menzies appraised the possibility of additional gas requirements after considering the future growth of electricity consumption in the industrial and the residential and commercial sectors.

Total electricity consumption was expected to rise from the equivalent of 26 trillion Btu's in 1969 to the equivalent of approximately 159 trillion Btu's in 1999. The assumption was made that fossil fuels would be used to generate the entire increase in the power load. As described in Appendix C, the growth in total fossil fuel requirements was estimated by applying a constant heat rate to the projected increase in the power load.<sup>(7)</sup> In recognition of Edmonton Power's plans to install gas-fired units at the Clover Bar site, the natural gas portion of fuel requirements was forecast

---

(6) The estimates prepared by Hedlin Menzies included gas used to generate electricity in industrial plants, as well as the gas requirements of electric utility companies.

(7) As used in this report, heat rates are defined as the average fuel requirements to generate 1 kilowatt hour (KWH) of electricity. Appendix C contains a discussion of the heat rates estimated by the submissions of Consolidated and other interveners.

to increase to a level of 53 billion cubic feet in 1980. Because price considerations were believed to indicate a general preference for coal rather than natural gas, all other additions to capacity were expected to be in the form of coal-fired units during this period. After 1980, Edmonton Power's additional fuel requirements were expected to be supplied by coal also. However, the estimates prepared by Hedlin Menzies assumed that 10 per cent of the incremental fossil fuel requirements of all electric utilities would be supplied by natural gas in the years after 1980. On this basis, Hedlin Menzies forecast that gas requirements for power generation would reach a level of approximately 85 billion cubic feet in 1999. The requirements, which are shown in column (2) of Table IV-4, total 1,766 billion cubic feet over the forecast period.

The levels of total electricity consumption in the forecast were based on annual growth rates for electricity of 7 and 5 per cent in the industrial and the residential and commercial sectors, respectively. Evidence at the hearing confirmed that these growth rates were intended to apply to the Province as a whole and not to particular areas, such as Edmonton, which might experience growth rates higher than the provincial average. One of the assumptions underlying the forecast was that there would be no net interprovincial transfers of electricity and, hence, that the electricity generated in Alberta would grow in accordance with the Province's consumption. Hedlin Menzies believed that there might be a tendency for the forecast to overestimate total fossil fuel requirements, insofar

as some of the growth in the power load might be generated by new hydro stations. A similar tendency was believed to be present in the forecast of natural gas requirements, which made no allowance for the fact that natural gas units were likely to be used more for peaking purposes later in the period.

The forecast of natural gas requirements reflected Hedlin Menzies' position that coal enjoyed a considerable cost advantage over natural gas. By way of illustration, the submission quoted coal costs of 10 cents per thousand cubic feet of natural gas equivalent for Calgary Power at Lake Wabamun, as compared to average gas costs of 18 cents. On the basis of its own analysis, as well as discussions with the various electric utilities, Hedlin Menzies anticipated that the price spread between the two fuels would widen over the forecast period as a result of more rapid increases in the price for natural gas.

At the hearing, the witnesses for Hedlin Menzies said that they had reached their conclusions with respect to relative fuel prices partly because there appeared to be abundant coal reserves in Alberta suitable for use in thermal generation. Conversations with the Alberta Research Council suggested that suitable deposits amounting to between 1 and 2 billion tons were recoverable by strip mining in the Province. The witnesses acknowledged that estimates of proved reserves might be somewhat less than these figures, but believed that greater exploration incentives would lead to the development of new reserves over the forecast period. By-products from coking coal operations



represented an additional source of supply, which was expected to become increasingly important in the future. The witnesses conceded that the sulphur content of such coal was relatively high and therefore pollution abatement costs were likely to be greater. Hedlin Menzies recognized that pollution problems were an important element in the choice between natural gas and coal. However, Hedlin Menzies submitted that, as a general rule, the problems associated with natural gas generating units were at least as severe as the problems resulting from the use of coal. Hedlin Menzies stated that similar opinions had been expressed by the Alberta Research Council.

The witnesses for Hedlin Menzies contended that it was reasonable to expect Edmonton Power to install coal-fired units after 1980. In preparing the submission, Hedlin Menzies had not considered which particular fields might supply the coal, nor had a detailed study been made of mining costs. The major reason for believing that Edmonton Power would choose coal, in preference to natural gas, was the large and widening price spread between the two fuels. In the opinion of the witnesses, it was this feature which had caused other electric utilities, such as Calgary Power, to plan their future requirements on the basis of coal-fired units.

### (3) Industrial Sector and Power Generation

The estimates of natural gas requirements for the industrial sector and for power generation have been combined in column (3) of Table IV-4. The combined estimates show an increase from

some 133 billion cubic feet in 1970 to 487 billion cubic feet in 1999, and total 8,226 billion cubic feet over the 30-year forecast period.

#### Views of the City of Edmonton

The City of Edmonton presented estimates of Edmonton Power's future gas requirements for power generation. On the basis of population projections and estimated trends in per capita usage of electricity, the City forecast that electricity consumption within Edmonton Power's service area would increase from 1,861,000 megawatt hours (MWH) in 1970 to 28,260,000 MWH in 1999, representing an average annual rate of growth of 9.8 per cent. The volumes of gas required to generate the anticipated power load were examined by the City in two parts.

In the first part of its analysis, the City assessed the gas requirements of the existing Rossdale station and the new Clover Bar generating station, at which four 165 megawatt (MW) units will be installed to meet increases in the power load during the initial ten years of the forecast. The City stated that natural gas would be the primary fuel used for power generation at both stations. Based on the projected power load, and a forecast of heat rates, the City estimated that the combined gas requirements of the two stations would rise from some 23 billion cubic feet in 1970 to 47 billion cubic feet in 1979 and remain constant at the 1979 level in subsequent years of the forecast. As shown in column (1) of Table IV-5, the annual requirements of the two stations were estimated to total 1,273

billion cubic feet over the 30-year forecast period.

Because of large prospective increases in electricity consumption between 1980 and 1999, the City predicted that three new generating stations would have to be added during this period. The second set of estimates developed by the City assumed that natural gas would supply the fuel requirements of these three additional stations. The City envisaged an expansion program involving completion of four 300 MW units at the Meadowlark site during the period 1980 to 1986, the installation of four 600 MW units at the Southwest site in the period 1988 to 1995, and the addition of one 1,200 MW unit at the Southeast site in 1997. For each station, the City used a forecast of heat rates to calculate the gas requirements associated with increases in the power load. The City recommended that, in 1980 and subsequent years, the requirements of these three stations should be added to the requirements of the Rossdale and Clover Bar stations in order to determine the overall gas requirements of Edmonton Power. As shown in column (2) of Table IV-5, this results in terminal year requirements of 283 billion cubic feet and total 30-year requirements of 3,068 billion cubic feet. The City recommended that these requirements be protected by the Board from the point of view of both supply and cost.

In preparing its forecast of electricity consumption, the City assumed that Edmonton Power's existing service area would be extended to include most of the Edmonton Metropolitan area. However, within the Metropolitan area, no provision was made for

the annexation of industrial loads which are served at the present time by Calgary Power. The demands on Edmonton Power's system were expected to grow partly in response to increases in population, but also because of a strong upward trend in KWH per capita.

To estimate population, the City relied mainly on a previous study by the Edmonton Regional Planning Commission. In the period 1970 to 1981, the population of Edmonton Power's service area was forecast to increase at a constant annual rate of 3.25 per cent, rising from 436 thousand in 1970 to 620 thousand in 1981. The annual growth rate was projected to decline thereafter and to be some 2.8 per cent by 1999, at which point the population was estimated at 1,060 thousand. It was the City's opinion that the population figures were reasonable in relation to both previous experience and the general outlook for the Edmonton region.

The City anticipated that, as in the past, the impact of population growth on electricity consumption would be magnified by continuing increases in per capita usage. Over the period 1970 to 1999, KWH per capita were expected to rise at the average historical rate of 6.5 per cent per year and to exhibit an almost sevenfold increase. The City believed that the rising trend in per capita consumption would be sustained over the forecast largely as a result of the introduction of new types of electrical appliances. In this connection, the City noted that 30,000 KWH was widely used as an upper limit on per capita consumption in the United States and that the City's own estimates of per



capita consumption did not approach this level until the end of the forecast.

The City acknowledged that the projected growth rate of 9.8 per cent per year in its own forecast of electricity consumption was higher than the growth rates used in forecasts by other large utilities in Canada. However, the City observed that historically electricity consumption had grown more rapidly on the Prairies than in other parts of Canada, and that Edmonton had experienced a higher growth rate than the average for the Prairies as a whole. At the hearing, the City contended that forecasts of electricity consumption in the United States did not provide a good parallel for the growth of Edmonton's power load. In the City's opinion, Edmonton could look forward to more rapid growth in electricity consumption because the economy of the region was less fully developed, and the opportunities for growth were correspondingly greater, than in many areas of the United States.

The City believed that the choice of gas as the preferred fuel for power generation was relatively clear-cut in the period 1970 to 1980. The City submitted that, after 1980, gas would remain the most economic fuel, although gas prices were expected to rise at a faster rate than prices for coal. A statement in the City's submission referred to an assurance given by the Provincial Government that the export of gas would not adversely affect the cost of gas to consumers in Alberta. Witnesses for the City said that the assurance had been given in a public statement issued by the Premier of Alberta after a meeting of interested

parties in the early part of 1970. The witnesses stated that this had been one among several factors leading to the conclusion that gas would be used in new generating stations after 1980.

The City had obtained information from Northwestern Utilities, Limited (NUL) regarding probable increases in the price of gas supplied to Edmonton Power. A letter written by NUL on June 3, 1970, stated that certain changes were appropriate in previous estimates of natural gas prices for the period 1975 to 1985. The letter said that the previous estimates of maximum prices for the period 1975 to 1980 were likely to be representative of average rather than maximum prices, and that some increases in maximum prices could be expected in the period 1980 to 1985. The City had assessed this information and concluded that natural gas would retain a competitive advantage over coal until at least 1985.

A number of other factors were expected to favour the use of gas throughout the forecast period. It was the City's opinion that pollution problems would continue to militate against the use of coal in urban environments. The evidence given by the City at the hearing referred to statistics on the pollution levels of a typical 1,000 MW plant in the United States. For a gas-fired plant, the article quoted by the City estimated the emissions of oxides of nitrogen and particulates at 26.6 and 1.02 million pounds per year, respectively. For a coal-fired plant, the corresponding levels were given as 46.0 and 9.9 million pounds per year. The City agreed that the latter numbers might not be representative of a coal-fired plant in Alberta, since the

sulphur content of the Province's coal was less than that of coal used in the United States. The important point, in the City's opinion, was that a number of former users were switching away from coal. In this connection, the City cited a recent decision by Ontario Hydro to substitute gas for coal in part of its operations.

An important element in the City's assessment was the fact that the capital cost of a gas-fired plant was low relative to that of a coal-fired plant. The City estimated the capital cost of a gas-fired plant to be approximately two-thirds the cost of an equivalent coal-fired plant and only one-third the cost of a nuclear station.

At the hearing, the City was asked to comment on previous evaluations of gas-fired and coal-fired stations. The City stated that the possibility of constructing a coal-fired station at Genesee had been considered in 1965, but rejected in favour of a gas-fired station at the Clover Bar site. At that time, the cost of coal from the Genesee field had been estimated at 15 cents per thousand cubic feet of natural gas equivalent. In order for the Genesee plant to have been competitive, the City advised that the price of natural gas would have had to be in the region of 25 cents per thousand cubic feet. The City estimated that, since 1965, the costs associated with the Genesee plant had risen by 10 per cent. Hence, under current conditions, the City calculated that gas would remain competitive at prices up to 27 cents per thousand cubic feet, as compared to the prevailing average

delivered price of 18 cents per thousand cubic feet. The City stated that it was aware that Calgary Power was able to obtain coal from the Wabamun field for a cost of approximately 10 cents per thousand cubic feet of natural gas equivalent. However, the City emphasized that these were not the terms on which coal was available to Edmonton Power at the Genesee field, chiefly because of the costs of opening up a new mine. Moreover, if coal were used to generate the whole of the additional power load after 1980, the City calculated that it would be necessary to develop new reserves of between 50 and 60 million tons in the Genesee field. This would involve Edmonton Power in considerable expense, with no assurance that the additional reserves could actually be proved up. Besides the Genesee and Wabamun fields, the City said that it knew of only three fields, at Ardley, Brooks and Sheerness, where coal reserves in excess of 100 million tons could be recovered economically. On the basis of previous studies, the City estimated that 12 cents per thousand cubic feet of natural gas equivalent would be the minimum cost for coal mined in the Ardley field.

The City's submission contained data on the use of gas for power generation in the United States. According to the City's estimates, the gas requirements of electric utilities in the United States were approximately 15 per cent of domestic natural gas production in 1969. By contrast, Edmonton Power's gas requirements in 1969 accounted for only slightly more than 1 per cent of Alberta's natural gas production. The submission referred



to the fact that gas was the prime fuel for power generation in south western and south central areas of the United States. Estimates were presented of the comparative costs of gas and other fuels in this region. In the course of questioning, witnesses for the City agreed that the price shown for natural gas related to interruptible supplies, whereas this was not the basis on which gas was supplied to Edmonton Power.

The City's witnesses were asked whether they believed Edmonton Power's gas requirements should be reduced below the recommended level of 3,068 billion cubic feet, in view of uncertainties regarding the type of fuel to be used in new generating stations after 1980. The City agreed that the gas requirements shown for these stations were less certain than the requirements of the Rossdale and Clover Bar stations, which were expected to be used increasingly for peaking purposes later in the forecast period. The City reiterated its opinion that the greater part of the evidence favoured the use of gas-fired rather than coal-fired units to generate the additional power load over the last 20 years of the forecast. At the same time, the City recognized the possibility that the situation might alter before 1975, at which date Edmonton Power was expected to have reached a decision regarding the type of fuel to be used in the first of the new generating stations. If coal did prove to be a more attractive fuel, the City said that it would be an easy enough matter to reduce the estimates of Edmonton Power's gas requirements at a later hearing. However, the City was

concerned that, if the estimates of gas requirements were reduced as a result of the current hearing, Edmonton Power might be placed in a position where it wished to proceed with a gas-fired expansion program, but was prevented from doing so because the necessary supplied of gas were no longer available within the Province.

#### Views of the City of Calgary

The City of Calgary submitted a position statement<sup>(8)</sup> which commented on the growth in the power load anticipated by the City of Edmonton for the Edmonton Power system. The City of Calgary believed the projections for the Edmonton Power system to be reasonable over the period 1970 to 1990. With respect to subsequent years of the forecast period, the City of Calgary alluded to a number of developments which might promote increases in electricity consumption even greater than the growth foreseen in the City of Edmonton submission. The City of Calgary submitted that the growth in electricity consumption on its own distribution system would parallel the growth within Edmonton Power's service area. In these circumstances, the City of Calgary contended that the question of which fuels would be used to generate electricity was a major issue.

#### Views of the Board

The Board has reviewed the evidence presented by the interveners

---

(8) The City of Calgary's position statement is reproduced in Appendix B.

on the Province's future Industrial and Contingent gas requirements. The Board believes that it is helpful to maintain a distinction between Industrial and Contingent gas requirements insofar as the Industrial gas requirements depict the growth which may be expected on the basis of relatively certain developments. The distinction between Industrial and Contingent gas requirements appears particularly useful in the early part of the forecast period when more complete information is available on the plans of large industrial users. The Board believes that the company surveys conducted by its own staff, the Combined Utilities and Foster are preferable as a means of establishing the levels of requirements in the first ten years of the forecast. The Board's own estimates for the period 1970 to 1979 have been based largely on the results obtained from these surveys, although the Board has found Hedlin Menzies' forecast to be a useful means of cross-checking the projected requirements during this period. The growth in the gas requirements of individual users cannot be predicted with the same degree of reliability after 1979, especially since the existing and planned capacity of most large industrial users will be fully utilized by this date. For the last 20 years of the forecast, therefore, the Board has estimated the levels of Industrial and Contingent gas requirements with reference to the main features of the energy forecasts submitted by Foster and Hedlin Menzies and other relevant evidence on energy requirements.

The Board's estimates of Industrial and Contingent gas

requirements for all uses are shown in columns (1) and (2) of Table IV-8. These estimates have been summed in column (3) of the Table. The combined requirements, as estimated by the Board, rise to 416 billion cubic feet in 1999, as compared to the 1970 level of 128 billion cubic feet, and total 8,520 billion cubic feet over the 30-year period. In the period 1970 to 1979, the major portion of the growth in the combined requirements has been allocated to Industrial gas requirements, which are estimated to increase from 128 to some 199 billion cubic feet. After 1979, the Board has held the annual volumes of Industrial gas requirements constant, and estimates that these requirements will total 5,610 billion cubic feet over the 30-year period. The growth in Contingent gas requirements after 1979 is commensurate with the growth in the combined requirements. Contingent gas requirements are expected to commence at a level of 2 billion cubic feet in 1971, rising to some 35 billion cubic feet in 1979 and reaching some 217 billion cubic feet in 1999. Contingent gas requirements are estimated to total 2,911 billion cubic feet over the 30-year period.

The following summary shows, at 10-year intervals and over the forecast period as a whole, a comparison between the Board's estimates of combined Industrial and Contingent gas requirements and the corresponding estimates of the various interveners.



Estimates of Combined Industrial and Contingent Gas Requirements  
for All Uses

(Billions of cubic feet)					
<u>Year</u>	<u>Board Staff</u>	<u>Combined Utilities</u>	<u>Consolidated (Hedlin Menzies)</u>	<u>Alberta &amp; Southern and TransCanada (Foster)</u>	<u>Board</u>
1979	253	244	201	222	234
1989	342	365	310	314	339
1999	424	487	487	381	416
30-Year Require- ments 1970 to 1999	8,847	9,294	8,226	7,886	8,520

The comparison reveals considerable variation between the various estimates, both on an annual basis and over the forecast period as a whole. For the terminal year the estimates of the Combined Utilities and Hedlin Menzies are identical but substantially higher than the Board's own estimates and the estimates of the Board staff and Foster. The difference between the two highest estimates for 1999 and the lowest estimate, submitted by Foster, is more than 100 billion cubic feet. The Board's estimate of combined Industrial and Contingent gas requirements in 1999 is 71 billion cubic feet less than the estimates of the Combined Utilities and Hedlin Menzies. The differences between the forecasts follow the same direction when the various estimates of 30-year requirements are compared. Foster's estimate of 30-year requirements is lower than the estimates of the other forecasters and also lower than the Board's estimate. The highest estimate of 30-year requirements, submitted by the

Combined Utilities, is over 1,400 billion cubic feet greater than Foster's estimate. In relation to the Board's estimate, the Combined Utilities' forecast of 30-year requirements is 774 billion cubic feet greater.

The differences between the interveners' forecasts of combined Industrial and Contingent gas requirements reflect, in part, different views regarding the volumes of gas required for power generation in the Province and the appropriateness of an allowance for the requirements of Peace River. Substantial differences in the interveners' forecasts of Industrial and Contingent gas requirements for power generation arose because of disagreement about Edmonton Power's requirements. For this reason, the Board has given separate consideration to the portion of Industrial and Contingent gas requirements relating to power generation. The estimates of requirements for users other than electric utilities were affected to a considerable extent by judgments regarding the likelihood of the commencement of operations at Peace River's proposed iron ore processing plant. The Board has decided, therefore, to treat the question of Peace River's gas requirements also as a separate issue.

The Board's views respecting the various components of Industrial and Contingent gas requirements are discussed in detail below.

(1) Industrial and Contingent Gas Requirements  
for Power Generation<sup>(9)</sup>

The Board's estimates of Industrial and Contingent gas

---

(9) The Board's estimates relate to the gas requirements of electric utilities only.

requirements for power generation are presented in Table IV-6. In total, the Board has estimated that these requirements will grow from 37 billion cubic feet in 1970 to a level of 116 billion cubic feet in 1987 and remain constant at the latter level in subsequent years of the forecast. The pattern of annual requirements, as shown in column (7) of the Table, results in 30-year requirements of 2,617 billion cubic feet.

In compiling the estimates, the Board has considered the evidence on the requirements of individual utility companies, as well as trends in electricity consumption and the main factors influencing the choice of fuels for power generation. The Board notes that the majority of electric utilities were expected to satisfy their incremental fuel requirements from sources other than gas. For the majority of utilities, therefore, the Board has not found it necessary to consider the future growth in the power load. By contrast, the City of Edmonton believed that sufficient gas should be reserved to supply all the fuel requirements of Edmonton Power over the forecast period. Consequently, evidence relating to electricity consumption and the competitive position of gas and other fossil fuels, is of most relevance to the needs of the Edmonton Power plant.

All the interveners accepted the City of Edmonton's view that, in the first ten years of the forecast, the fuel requirements of the Edmonton Power plant would be supplied entirely by gas. For the first ten years of the forecast, the Combined Utilities and Foster also accepted the City of Edmonton's

estimates of Edmonton Power's gas requirements, which were based on an annual growth of 9.8 per cent in electricity consumption and on heat rate data for the existing Rosssdale station and the new Clover Bar station. The City judged that both these stations would be operating at capacity in 1979 and that the annual requirements of the two stations would amount to 47 billion cubic feet of gas by that date.

In preparing its own estimates, the Board has adopted the City of Edmonton's schedule for the gas requirements of the Rosssdale and Clover Bar stations up to the end of 1979. The Board observes that its own staff used somewhat higher estimates for Edmonton Power's gas requirements in the period 1970 to 1979. However, the staff indicated at the hearing that it wished to revise these estimates in accordance with the evidence submitted by the City of Edmonton. In common with the other forecasters, Hedlin Menzies believed that Edmonton Power's gas requirements should be based on the assumption that gas would be used to generate the power load during the period 1970 to 1979. Although Hedlin Menzies did not give details of its estimates for Edmonton Power's gas requirements, its forecast of gas requirements for power generation throughout the Province was some 51 billion cubic feet in 1979, or only 4 billion cubic feet greater than the level of requirements adopted by the Board for Edmonton Power. This suggests to the Board that Hedlin Menzies anticipated that electricity consumption on Edmonton Power's system would be somewhat less than the estimates submitted by the City of Edmonton.

The Board realizes that the City of Edmonton's forecast of electricity consumption on the Edmonton Power system embodies a high growth rate. However, the Board believes this growth rate to be realistic during the period 1970 to 1979, in view of historical increases in electricity consumption in the Edmonton area and the City's evidence on trends in KWH per capita. The Board notes that the City of Calgary agreed with the City of Edmonton's projections for the period 1970 to 1990 and that during the first decade of the forecast, Foster used a growth rate for electricity consumption which was only marginally lower than the rate used by the City of Edmonton.

Conflicting views were expressed at the hearing about the growth in Edmonton Power's gas requirements after 1979. The Board staff did not relate the growth in Edmonton Power's gas requirements to the installation of new capacity. On the basis of the original estimates in the staff's submission, Edmonton Power's gas requirements were projected to reach 103 billion cubic feet by 1999. In the submission of the Combined Utilities, no provision was made for increases in Edmonton Power's gas requirements after 1979. However, the Combined Utilities believed that a provision for further growth might be desirable, depending on the Board's assessment of the City of Edmonton's forecast of electricity consumption. Foster assumed that the growth of electricity consumption in the Edmonton area would moderate slightly in the period 1981 to 1989 and that the growth in Edmonton Power's fuel requirements would be supplied equally by



coal and gas. Foster's forecast assumed that all the growth in Edmonton Power's fuel requirements after 1989 would be met by coal. Hedlin Menzies expressed the opinion that new stations constructed by Edmonton Power during the last 20 years of the forecast would be based on coal but, during this period, gas was assumed to supply 10 per cent of all incremental fuel requirements for power generation in the Province.

In estimating Edmonton Power's gas requirements after 1979, the Board has adopted the average annual growth rate for electricity consumption of 9.8 per cent contained in the City of Edmonton's submission. The Board recognizes the possibility that this growth rate may moderate during the last 20 years of the forecast, but believes that the bulk of the evidence supported high growth rates for electricity consumption. For the Province as a whole, Hedlin Menzies used an annual growth rate in electricity consumption of 7 per cent for industrial uses and 5 per cent for residential and commercial uses. At the hearing, however, Hedlin Menzies acknowledged that the City of Edmonton was likely to experience growth rates higher than the provincial average. Foster believed that the growth rate of electricity consumption on the Edmonton Power system, and within the Province as a whole, would average 8 per cent in the 1980's. The City of Calgary agreed with the City of Edmonton's forecast of electricity consumption up to the end of 1990, but foresaw even more rapid growth during the final years of the forecast. In the light of this evidence the Board does not believe it would

be appropriate to make any reduction in the City of Edmonton's forecast of electricity consumption for the period after 1979.

Very substantial additions to generating capacity will have to be made by Edmonton Power to accommodate the prospective increases in the power load after 1979. By the mid-1970's Edmonton Power expects to have reached a decision on whether gas or coal will be used as a basis for expansion in the 1980's. Both Foster and Hedlin Menzies predicted that gas would become more expensive relative to coal during the forecast period. The City of Edmonton concurred with this view but estimated that gas would remain the preferred fuel for Edmonton Power's new generating stations until at least 1985. The City's position was supported by reference to information received from NUL on future trends in gas prices. The Board is in general agreement with the City of Edmonton's assessment of the competitiveness of gas and coal in the first half of the 1980's. The Board expects that the competitive advantage which gas enjoys in Edmonton Power's current operations will be eroded as a result of more rapid increases in the price of gas as opposed to coal. However, the Board notes that, on the basis of the City's current estimates of coal costs in the Genesee field, some 17 cents per million Btu's, gas would remain competitive at prices up to 27 cents per thousand cubic feet, primarily because of the higher capital costs of coal-fired stations. This evidence suggests to the Board that, despite prospective increases in gas prices, there is a reasonable expectation that gas will be used in Edmonton Power's expansion

program through the mid-1980's. Accordingly, the Board has provided for an increase in Edmonton Power's gas requirements from a level of 47 billion cubic feet in 1979 to a level of 95 billion cubic feet in 1987. The growth during this period is based on the installation of four 300 MW units at the Meadowlark site.

The Board expects that gas prices will continue to rise more rapidly than coal prices in the period after the completion of the Meadowlark site. The Board believes it is extremely difficult to quantify trends in the prices of the two fuels in the later period, and the Board does not regard the evidence on this matter as conclusive. However, it is the Board's judgment that coal, as well as gas, will be used in Edmonton Power's generating stations during the later years of the forecast. Although the Board foresees the possibility that additional gas units may be constructed after the completion of the Meadowlark site, the Board believes there will be an increasing tendency to use some existing gas units mainly for peaking purposes. The City of Edmonton anticipated a similar role for the older gas units and both Foster and Hedlin Menzies supported this view. Therefore, despite the fact that some additional gas units may be installed after the completion of the Meadowlark site, the Board does not expect that Edmonton Power's annual gas requirements will show appreciable growth in subsequent years. Moreover, the Board believes the possibility should be acknowledged that there may be some reduction

in the growth rate of electricity consumption during the later years of the forecast. In view of these considerations, the Board has concluded that Edmonton Power's gas requirements should be maintained at a constant level of 95 billion cubic feet after the installation of the Meadowlark site is completed.

The Industrial and Contingent gas requirements which the Board has allocated to Edmonton Power are contained in Table IV-6. Column (1) of the Table shows the Industrial gas requirements which, over the period 1970 to 1979, relate to the Rosssdale and Clover Bar stations. The Board regards the estimate of Industrial gas requirements in 1979 as relatively certain, and the Board has maintained the annual Industrial requirements constant at this level over the remainder of the forecast. Column (4) of Table IV-6 shows the Contingent portion of Edmonton Power's gas requirements, associated with increases in electricity consumption subsequent to 1979. Since the Board expects little change in the gas requirements of all Edmonton Power's stations after the completion of the Meadowlark site, the Contingent gas requirements in column (4) have been held constant during the later years of the forecast. On this basis, the Board estimates that Industrial and Contingent gas requirements for Edmonton Power will total 1,273 and 769 billion cubic feet, respectively, over the 30-year forecast period. For comparative purposes, the estimates of the Board and the interveners for Edmonton Power's combined Industrial and Contingent gas requirements are shown below.

Estimates of Combined Industrial and Contingent Gas  
Requirements for Edmonton Power  

---

(Billions of cubic feet)

<u>Year</u>	<u>Board Staff</u>	<u>Edmonton Power</u>	<u>Combined Utilities*</u>	<u>Alberta &amp; Southern and TransCanada** (Foster)</u>	<u>Board</u>
1979	56	47	47	49	47
1989	80	114	47	76	95
1999	103	283	47	76	95
30-Year Require- ments 1970 to 1999	1,989	3,068	1,273	1,741	2,042

\* Based on a schedule for the Rosssdale and Clover Bar stations only.

\*\* As estimated by the Board. No provision has been made for a decline in the requirements of the Rosssdale station after 1989.

The evidence regarding the Industrial and Contingent gas requirements of electric utilities other than Edmonton Power revealed a substantial measure of agreement. A decline was expected in the gas requirements of the Lethbridge Power plant, since a portion of the City of Lethbridge's electricity needs will be supplied in future by Calgary Power. A large reduction was anticipated in the gas requirements of Calgary Power, reflecting the fact that the one remaining gas unit at Wabamun will be used primarily for peaking purposes. Similarly, Canadian Utilities and Northland Utilities plan to place more reliance on coal as opposed to gas units, with consequent reductions in gas requirements during the first five years of the forecast period.



Subsequently, gas was expected to displace fuel oil in some existing installations and the gas requirements were expected to show some increase. The City of Medicine Hat was the only utility which indicated that future increases in fuel requirements would be supplied entirely by gas.

The Board realizes that the estimates supplied to the interveners by some of the electric utilities were of a confidential nature. However, the Board has had the opportunity to consider the estimates of gas requirements which were supplied by electric utilities to the Board staff. The Board is in agreement with these estimates and, as shown in column (2) of Table IV-6, has adopted for the period 1970 to 1979, the Industrial gas requirements used by the staff for electric utilities other than Edmonton Power. These requirements exhibit an erratic pattern in the early years of the forecast but thereafter gradually rise to a constant level of some 15 billion cubic feet per year. The Board has held the requirements constant at this level after 1979 and, on this basis, 30-year requirements are estimated at 434 billion cubic feet.

In addition to the Industrial gas requirements for electric utilities other than Edmonton Power, the Board has allocated a portion of Contingent gas requirements to these utilities, as shown in column (5) of Table IV-6. In the period up to 1979, these volumes are intended to accommodate possible emergency loads on Calgary Power's system as well as the use of gas as a supplementary fuel in coal-fired stations on the Canadian Utilities'

and Northland Utilities' systems. The Board believes that an annual Contingent volume of some 6 billion cubic feet, similar to the 1979 level, should be retained through to 1999. The 30-year Contingent gas requirements allotted to electric utilities other than Edmonton Power amount to 142 billion cubic feet. Combining these requirements with the Industrial gas requirements for electric utilities other than Edmonton Power, results in a 30-year total of 576 billion cubic feet.

(2) Industrial and Contingent Gas Requirements  
Excluding Power Generation and Peace River<sup>(10)</sup>

For purposes of discussion, the Board will refer to industrial users other than electric utilities and Peace River as general industrial users. The Board's estimates of Industrial and Contingent gas requirements for these general users are presented in Table IV-7. As shown in column (3) of the Table, the combined Industrial and Contingent gas requirements for general users are estimated to increase from 91 billion cubic feet in 1970 to a level of 166 billion cubic feet in 1979, and to reach a level of 300 billion cubic feet by 1999. The annual volumes yield 30-year requirements of 5,903 billion cubic feet. A comparison between the Board's estimates of combined Industrial and Contingent gas requirements for general users and the estimates of the interveners is given below.

---

(10) The Board's estimates include gas used to generate electricity in industrial plants.

Estimates of Combined Industrial and Contingent  
Gas Requirements Excluding Power Generation and  
Peace River

(Billions of cubic feet)

<u>Year</u>	<u>Board Staff</u>	<u>Combined Utilities*</u>	<u>Consolidated** (Hedlin Menzies)</u>	<u>Alberta &amp; Southern and TransCanada (Foster)</u>	<u>Board</u>
1979	166	166	150	156	166
1989	214	217	247	214	223
1999	252	282	402	293	300
30-Year Require- ments 1970 to 1999	5,672	5,767	6,460	5,629	5,903

\* The numbers compiled for the Combined Utilities are based on the numbers in column (9) of Table IV-2, from which the Board has subtracted the Combined Utilities' estimates of Edmonton Power's and Peace River's requirements. A further reduction was made by the Board to reflect the requirements of electric utilities other than Edmonton Power. For this purpose, the Board has used the estimates of the Industrial gas requirements for other electric utilities shown in column (2) of Table IV-6. No adjustment has been made for the Contingent gas requirements of these electric utilities.

\*\* The Board has assumed that Hedlin Menzies' forecast does not reflect gas requirements for Peace River. The evidence relating to Hedlin Menzies' forecast did not clarify whether the estimates were intended to accommodate the gas requirements of this scheme.

There is reasonably close correspondence between the estimates of all the interveners for 1979. An increasing divergence is evident between Hedlin Menzies' forecast and the estimates of the other forecasters in 1989 and 1999. In 1989, the estimates of the Board staff, the Combined Utilities and Foster are almost identical. However, the Board staff's estimate for 1999 is lower than the estimates of both Foster and the Combined Utilities. Hedlin

Menzies' forecast is considerably higher than the estimates of any of these interveners both on an annual and a 30-year basis. The forecasts of the Board staff, the Combined Utilities and Foster show close agreement on a 30-year basis. Foster submitted the lowest estimate of 30-year requirements, 5,629 billion cubic feet, which is 43, 138 and 831 billion cubic feet less than the respective forecasts of the Board staff, the Combined Utilities and Hedlin Menzies.

In keeping with the earlier discussion of the Board's views on methods of estimating the requirements, the Board has based its own forecast for the period 1970 to 1979 on information supplied by gas customers. The Board recognizes merit in the forecasting approach employed by Hedlin Menzies and believes the various factors considered by Hedlin Menzies to be helpful, particularly with respect to the long-term growth of requirements. However, in the early years of the forecast period, the Board believes that the annual requirements of general industrial users should be based, wherever possible, on the actual intentions of existing and prospective users.

For purposes of determining the Industrial gas requirements of the general users, the Board has used the estimates of its own staff for the period 1970 to 1979. As shown in column (1) of Table IV-7 the annual requirements are expected to grow from 91 billion cubic feet in 1970 to 137 billion cubic feet in 1979. The Board has calculated the corresponding requirements in the forecasts of the Combined Utilities and Foster to be some 134

and 123 billion cubic feet, respectively. In view of the very close agreement between the forecasts of the Board staff and the Combined Utilities, and because the surveys conducted by these two interveners were more extensive than Foster's survey, the Board believes that the staff's survey provides a reliable means of estimating the Industrial gas requirements of general users during the period up to and including 1979. It is the Board's opinion that gas will supply the greater part of the growth in the fuel requirements of the companies encompassed by the survey. There appears to be little doubt that gas will continue to be used in the existing plants of these companies. Similarly, the majority of planned additions to plant capacity appear to be based on the use of gas as a fuel or raw material.

Beyond 1979, the Board has maintained the Industrial gas requirements of the general users constant at a level of 137 billion cubic feet. The Board notes that the existing and planned capacity of most of the companies in the staff's survey is expected to be fully utilized in 1979. Although the Board anticipates that the gas requirements of these companies and companies operating smaller plants will show further growth, the Board believes such growth should be allocated to Contingent gas requirements. Both the Combined Utilities and Foster favoured a similar procedure. On this basis the Board estimates that the 30-year Industrial gas requirements of the general users will amount to 3,903 billion cubic feet.

The Board's estimates of Contingent gas requirements for



general industrial users are shown in column (2) of Table IV-7. These requirements commence at a level of 1 billion cubic feet in 1972, rising to a constant level of 29 billion cubic feet in the period 1977 to 1979. During the years up to and including 1979, the requirements, which are based on the estimates in the Board staff's submission, are intended to reflect new industrial projects, such as the Syncrude project, a new sulphate plant at Metiskow, the establishment of two new pulp mills in the Province and the use of gas for coal drying at a second mining operation in the Grande Cache area. In addition, the growth in Contingent gas requirements up to and including 1979 reflects small incremental requirements for existing general users. The developments underlying the Contingent gas requirements adopted by the Board are similar to the developments discussed by Foster. Foster estimated the Contingent gas requirements of general industrial users at some 34 billion cubic feet in 1979, as compared to the Board's estimate of 29 billion cubic feet. The Combined Utilities' estimate of Contingent gas requirements for all users, except Peace River, was 32 billion cubic feet in 1979.

The Board's estimates of combined Industrial and Contingent gas requirements for general users during the period 1970 to 1979 exhibit substantial growth, equivalent to an average annual rate of some 7 per cent. The Board notes that its own estimate for 1979, which was adopted from the Board staff's submission, is virtually identical to the estimate submitted by the Combined

Utilities. A similar comment applies to the Board's estimate for 1979 in relation to Foster's estimate, which was obtained largely from a customer survey but which was examined later within the context of a total energy forecast. There is also close correspondence between the Board's estimate for 1979 and Hedlin Menzies' estimate, which was derived directly from a projection of total energy requirements. The Board believes the energy forecasts provide additional confirmation that substantial growth will occur in the gas requirements during the period 1970 to 1979. Because the energy forecasts of Foster and Hedlin Menzies employed different definitions, the Board has not been able to compare the two forecasts of energy requirements on a sector-by-sector basis. However, as discussed in Appendix C and shown in Table C-9, the Board has adjusted Foster's forecast of energy requirements for all sectors in order to permit a comparison with the energy forecast prepared by Hedlin Menzies. After adjustment by the Board, Foster's forecast of total energy requirements for all sectors yields an average annual growth rate of 4.5 per cent over the period 1970 to 1979, as compared to 4.3 per cent in Hedlin Menzies' forecast. The 1979 estimates of energy requirements in the respective forecasts are 410 and 382 trillion Btu's. The Board notes that the relatively high growth rates for gas in the two forecasts during the period 1970 to 1979 were expected to be achieved largely at the expense of growth in petroleum and coal consumption by users other than electric utilities. The Board is in general agreement with this

assessment. The growth projected for electricity consumption during the period 1970 to 1979 also was expected to limit growth in petroleum and coal consumption by users other than electric utilities. The Board notes that, although the forecasts of Foster and Hedlin Menzies employed different growth rates for electricity consumption, the impact of these different growth rates does not become significant during the first ten years of the forecast, due to the low levels of electricity consumption in the initial years.

For the reasons already discussed, the Board has allocated all the growth in the gas requirements of general industrial users to the Contingency Allowance after 1979. The Board has determined the growth of the requirements during the last 20 years of the forecast with reference to the main considerations underlying the energy forecasts of Foster and Hedlin Menzies. Both Foster and Hedlin Menzies anticipated that the growth in total energy requirements would moderate after 1979. After adjustment by the Board, the total energy requirements for all sectors in Foster's forecast exhibit an average annual growth rate of 3.8 per cent during the period 1980 to 1999 and, as shown in Table C-9 of Appendix C, reach a level of 853 trillion Btu's in the terminal year. The total energy requirements for all sectors in Hedlin Menzies' forecast also were projected to grow at an average annual rate of 3.8 per cent during the period 1980 to 1999 and to reach 811 trillion Btu's at the end of the period. Although the two projections of total energy requirements

for all sectors are very similar, there is an increasing divergence between the estimates of gas requirements. The gas requirements shown in Table C-9 exclude requirements for power generation, permit related requirements and the operating requirements of gas utility companies. The differences between the estimates of gas requirements in the two energy forecasts are largely attributable, therefore, to the different estimates of Industrial and Contingent gas requirements for general users. The more rapid growth in these requirements predicted by Hedlin Menzies is associated with an average annual growth rate of 7 per cent for the electricity consumption of industrial users. Foster did not present a separate forecast of electricity consumption for industrial users, but estimated that the growth of electricity consumption in all uses would average 9 per cent in the 1970's, 8 per cent in the 1980's and 7 per cent during the final period of the forecast. The Board notes that, although different assumptions with respect to electricity consumption do not have an important bearing on gas requirements during the first ten years of the forecast, these assumptions do have a significant impact during the later period. It is the Board's opinion that the greater part of the evidence adduced at the hearing supported high growth rates for electricity consumption throughout the forecast period. In view of this evidence, the Board believes that the growth of electricity consumption by industrial users is likely to exceed the estimate in Hedlin Menzies' forecast. It is the Board's view that the emergence of electricity as a

major source of industrial energy will restrict the growth in the Industrial and Contingent gas requirements of general users during the later years of the forecast period. For this reason, the Board believes that Foster's forecast provides a better approximation of the growth in the combined Industrial and Contingent gas requirements of general users during the later period. On the basis of these considerations, the Board has projected that the requirements will grow at an average annual rate of 3 per cent after 1979 reaching a level of 300 billion cubic feet in 1999. All the growth after 1979 has been attributed to Contingent gas requirements, which increase from 29 billion cubic feet in 1979 to 163 billion cubic feet in 1999. This method of allocating the requirements results in 30-year Contingent gas requirements of 2,000 billion cubic feet.

(3) Consideration of Peace River's Gas Requirements

The Board's estimates of Industrial and Contingent gas requirements for general users are not intended to include a provision for the gas requirements of Peace River's proposed iron ore processing plant. In view of previous postponements in this scheme and the current excess supply in markets for iron powder, and also because feasibility studies had not been completed, the Board staff believed that the total requirements of some 2,000 billion cubic feet, which would result from an amended start-up date in 1975, should be reduced to 500 billion cubic feet. In recognition of similar uncertainties, Foster recommended that no allowance should be made for the gas requirements of the



Peace River scheme. The Combined Utilities made no judgment on the likelihood of the Peace River project but, mainly for illustrative purposes, showed an estimate of Peace River's total requirements which amounted to 1,812 billion cubic feet, based on a start-up date in 1976. Hedlin Menzies stated that its estimates of overall energy requirements would accommodate large new users of industrial energy, such as the Peace River operation. However, Hedlin Menzies did not state whether or not such increases in energy requirements would be supplied by gas.

The Board notes that, in the past, the Peace River project has been characterized by a number of deferments in the start-up date. The revised start-up date in the mid-1970's appears to the Board to be equally uncertain. The information provided to the staff by Peace River indicated that further tests on samples of Alberta ore would be delayed until all sections of Peace River's plant at Amherstburg, Ontario, were in full operation. The Board is unable to anticipate the results which will be obtained from these tests. A further complication regarding the Peace River scheme has been introduced by new information concerning the current excess supply in iron powder markets. The current state of excess supply has led to a deterioration in product prices. This feature, unless corrected, will prejudice the Alberta project. Moreover, the viability of Peace River's plant in Alberta is partly dependent on abundant supplies of low-cost gas. Therefore, the Board believes that the upward trend in gas prices will also be unfavourable to the Peace River project.

In view of the above considerations, the Board is of the opinion that it would be inappropriate to allocate volumes of gas specifically to the Peace River iron ore processing plant. The Board notes that its own estimate of Industrial and Contingent gas requirements for the general users exceeds the corresponding estimates of the Board staff, the Combined Utilities and Foster by 231, 136 and 274 billion cubic feet, respectively. These differences indicate to the Board that its own forecast will cover the needs of at least one additional large industrial user of gas not included in the other three forecasts. The corresponding estimate of 30-year Industrial and Contingent gas requirements for general users in Hedlin Menzies' forecast is 557 billion cubic feet greater than the estimate adopted by the Board. However, as stated previously in connection with its assessment of the future growth in electricity consumption, the Board believes that Hedlin Menzies' forecast will overstate the actual requirements of existing and new users of gas in the Province.



TABLE IV-1

BOARD STAFF

FORECASTS OF INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS  
(BILLIONS OF CUBIC FEET)

<u>YEAR</u>	<u>BASIC INDUSTRIAL (1)</u>	<u>SPECIAL INDUSTRIAL (2)</u>	<u>TOTAL INDUSTRIAL (3)</u>	<u>CONTINGENT (4)</u>	<u>TOTAL INDUSTRIAL AND CONTINGENT (5)</u>
1970	12.8	114.5	127.3	-	127.3
1971	13.2	115.1	128.3	1.5	129.8
1972	13.5	125.1	138.6	3.0	141.6
1973	13.9	135.4	149.3	8.8	158.1
1974	14.4	143.6	158.0	13.7	171.7
1975	14.8	161.0	175.8	22.6	198.4
1976	15.2	167.6	182.8	33.6	216.4
1977	15.7	173.9	189.6	41.6	231.2
1978	16.2	183.5	199.7	43.1	242.8
1979	16.7	191.2	207.9	44.6	252.5
1980	17.2	196.9	214.1	59.6	273.7
1981	17.7	202.6	220.3	62.7	283.0
1982	18.2	208.2	226.4	65.3	291.7
1983	18.7	213.1	231.8	66.9	298.7
1984	19.3	218.3	237.6	68.5	306.1
1985	19.9	223.9	243.8	70.6	314.4
1986	20.5	228.7	249.2	72.3	321.5
1987	21.1	233.2	254.3	74.0	328.3
1988	21.7	237.7	259.4	75.7	335.1
1989	22.4	242.5	264.9	76.9	341.8
1990	23.1	247.6	270.7	79.6	350.3
1991	23.8	251.6	275.4	86.8	362.2
1992	24.5	255.9	280.4	89.0	369.4
1993	25.2	260.3	285.5	91.2	376.7
1994	26.0	264.8	290.8	93.4	384.2
1995	26.7	269.5	296.2	96.1	392.3
1996	27.5	274.2	301.7	98.3	400.0
1997	28.4	279.0	307.4	100.5	407.9
1998	29.2	283.9	313.1	102.7	415.8
1999	30.1	289.0	319.1	105.0	424.1
30-YEAR REQUIREMENTS 1970 TO 1999	608	6,392	6,999	1,848	8,847
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	3.0	3.2	3.2		4.2

TABLE

COMBINED

FORECASTS OF INDUSTRIAL AND  
(BILLIONS OF

YEAR	SPECIAL INDUSTRIAL			
	BASIC	EXCLUDING	EDMONTON	TOTAL
	INDUSTRIAL	EDMONTON POWER	POWER	SPECIAL
	(1)	(2)	(3)	(4)
1970	13.2	94.7	23.3	118.0
1971	13.7	94.2	23.3	117.5
1972	14.0	101.8	26.5	128.3
1973	14.3	109.7	28.5	138.2
1974	14.5	114.2	30.3	144.5
1975	14.9	120.5	33.8	154.3
1976	15.4	123.6	37.0	160.6
1977	15.8	126.2	39.8	166.0
1978	16.3	129.4	43.3	172.7
1979	16.7	132.2	47.0	177.9
1980	17.1	132.0	47.0	179.0
1981	17.6	131.7	47.0	178.7
1982	18.0	131.5	47.0	178.5
1983	18.4	131.3	47.0	178.3
1984	18.9	131.1	47.0	178.1
1985	19.4	130.9	47.0	177.9
1986	19.8	130.9	47.0	177.9
1987	20.3	130.9	47.0	177.9
1988	20.8	130.9	47.0	177.9
1989	21.2	130.9	47.0	177.9
1990	21.8	130.9	47.0	177.9
1991	22.3	130.9	47.0	177.9
1992	22.8	130.9	47.0	177.9
1993	23.3	130.9	47.0	177.9
1994	23.9	130.9	47.0	177.9
1995	24.5	130.9	47.0	177.9
1996	25.0	130.9	47.0	177.9
1997	25.6	130.9	47.0	177.9
1998	26.2	130.9	47.0	177.9
1999	26.8	130.9	47.0	177.9
30-YEAR REQUIREMENTS 1970 TO 1999	583	3,768	1,273	5,040
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.5	1.1	2.5	1.4



IV-2

UTILITIES

CONTINGENT GAS REQUIREMENTS  
(CUBIC FEET)

TOTAL INDUSTRIAL (5)	C O N T I N G E N T			TOTAL INDUSTRIAL AND CONTINGENT (9)
	EXCLUDING PEACE RIVER (6)	PEACE RIVER (7)	TOTAL CONTINGENT (8)	
131.2	-	-	-	131.2
131.2	-	-	-	131.2
142.3	4.0	-	4.0	146.3
152.5	8.0	-	8.0	160.5
159.0	12.0	-	12.0	171.0
169.2	16.0	-	16.0	185.2
176.0	20.0	6.6	26.6	202.6
181.8	24.0	6.6	30.6	212.4
189.0	28.0	16.5	44.5	233.5
179.2	32.0	16.5	48.5	244.4
196.1	36.0	26.4	62.4	258.5
196.3	41.0	26.4	67.4	263.7
196.5	46.0	34.2	80.2	276.7
196.7	51.0	34.2	85.2	281.9
197.0	56.0	85.0	141.0	338.0
197.3	61.0	85.0	146.0	343.3
197.7	66.0	85.0	151.0	348.7
198.2	71.0	85.0	156.0	354.2
198.7	76.0	85.0	161.0	359.7
199.1	81.0	85.0	166.0	365.1
199.7	86.0	85.0	171.0	370.7
200.2	92.0	85.0	177.0	377.2
200.7	98.0	85.0	183.0	383.7
201.2	104.0	85.0	189.0	390.2
201.8	110.0	85.0	195.0	396.8
202.4	116.0	142.0	258.0	460.4
202.9	122.0	142.0	264.0	466.9
203.5	128.0	142.0	270.0	473.5
204.1	134.0	142.0	276.0	480.1
204.7	140.0	142.0	282.0	486.7

5,623

1,859

1,812

3,671

9,294

1.6

4.6

TABLE

ALBERTA & SOUTHERN  
(FOSTER)

FORECASTS OF INDUSTRIAL AND  
(BILLIONS OF

YEAR	POWER GENERATION			EXCLUDING POWER GENERATION		
	INDUSTRIAL (1)	CONTINGENT (2)	TOTAL* (3)	INDUSTRIAL (4)	CONTINGENT (5)	TOTAL (6)
1970	35.8	-	35.8	90.7	0.8	91.5
1971	32.8	-	32.8	94.1	1.5	95.6
1972	37.2	-	37.2	98.3	1.5	99.8
1973	38.7	1.5	40.1	101.7	3.2	104.9
1974	38.3	3.5	41.9	104.8	10.6	115.4
1975	38.0	11.0	48.9	108.3	20.9	129.2
1976	37.7	14.5	52.2	111.3	22.8	134.1
1977	37.5	17.5	55.0	114.9	31.5	146.4
1978	37.4	23.2	60.6	118.8	33.5	152.3
1979	37.3	28.5	65.8	122.5	33.5	156.0
1980	37.3	32.5	69.8	123.7	34.8	158.5
1981	37.3	34.9	72.2	123.9	36.2	160.1
1982	37.3	37.3	74.6	124.0	50.5	174.5
1983	37.3	40.0	77.3	124.2	52.0	176.2
1984	37.3	42.7	80.0	124.4	58.2	182.6
1985	37.3	48.3	85.7	124.5	63.9	188.4
1986	37.3	52.1	89.3	124.7	69.7	194.4
1987	37.3	56.0	93.3	124.8	75.8	200.6
1988	37.3	59.7	97.0	125.0	82.0	207.0
1989	37.3	63.5	100.8	125.2	88.4	213.6
1990	37.3	63.5	100.8	125.4	95.1	220.5
1991	37.3	63.5	100.8	125.5	102.0	227.5
1992	27.3	66.6	93.9	125.8	109.1	234.9
1993	27.3	67.1	94.4	126.0	116.3	242.3
1994	27.3	67.5	94.8	126.2	123.9	250.1
1995	27.3	67.5	94.8	126.5	131.7	258.2
1996	27.3	67.5	94.8	126.7	135.7	262.4
1997	27.3	69.6	96.9	127.0	147.9	274.9
1998	17.3	70.3	87.6	127.2	156.6	283.8
1999	17.3	71.1	88.4	127.4	165.4	292.8
30-YEAR REQUIREMENTS						
1970 TO 1999	1,017	1,241	2,258	3,574	2,055	5,629
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	-2.5		3.2	1.2		4.1

\* DIFFERENCE IN TOTAL DUE TO ROUNDING.

IV-3

AND TRANSCANADA

CONTINGENT GAS REQUIREMENTS  
(CUBIC FEET)

<u>TOTAL INDUSTRIAL (7)</u>	<u>TOTAL CONTINGENT (8)</u>	<u>TOTAL INDUSTRIAL AND CONTINGENT* (9)</u>
126.5	0.8	127.3
126.9	1.5	128.4
135.5	1.5	137.0
140.4	4.7	145.1
143.1	14.1	157.2
146.3	31.9	178.2
149.0	37.3	186.3
152.4	49.0	201.4
156.2	56.7	212.9
159.8	62.0	221.8
161.0	67.3	228.3
161.2	71.1	232.3
161.3	87.8	249.1
161.5	92.0	253.5
161.7	100.9	262.6
161.8	112.2	274.0
162.0	121.8	283.8
162.1	131.8	293.9
162.3	141.7	304.0
162.5	151.9	314.4
162.7	158.6	321.3
162.8	165.5	328.3
153.1	175.7	328.8
153.3	183.4	336.7
153.5	191.4	344.9
153.8	199.2	353.0
154.0	203.2	357.2
154.3	217.5	371.8
144.5	226.9	371.4
144.7	236.5	381.2
4,590	3,296	7,886
0.5		3.9

TABLE IV-4

CONSOLIDATED  
(HEDLIN MENZIES)  
FORECASTS OF INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS  
(BILLIONS OF CUBIC FEET)

<u>YEAR</u>	<u>EXCLUDING POWER GENERATION (1)</u>	<u>POWER GENERATION (2)</u>	<u>TOTAL INDUSTRIAL AND CONTINGENT (3)</u>
1970	94.0	39.4	133.4
1971	99.2	40.4	139.6
1972	104.5	41.5	146.0
1973	110.2	42.6	152.8
1974	115.9	43.8	159.7
1975	122.1	45.1	167.2
1976	128.6	46.5	175.1
1977	135.4	48.0	183.4
1978	142.5	49.5	192.0
1979	150.0	51.1	201.1
1980	157.5	52.9	210.4
1981	165.7	53.8	219.5
1982	174.3	54.8	229.1
1983	183.4	55.8	239.2
1984	192.5	56.9	249.4
1985	202.5	58.0	260.5
1986	212.9	59.3	272.5
1987	223.7	60.6	284.3
1988	235.2	62.0	297.2
1989	246.7	63.5	310.2
1990	259.3	65.1	324.4
1991	272.5	66.7	339.2
1992	286.2	68.5	354.7
1993	300.2	70.4	370.6
1994	315.3	72.4	387.7
1995	331.2	74.5	405.7
1996	347.8	76.8	424.6
1997	365.3	79.2	444.5
1998	383.5	81.8	465.3
1999	402.2	84.6	486.8
30-YEAR REQUIREMENTS 1970 TO 1999	6,460	1,766	8,226
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	5.1	2.7	4.6

TABLE IV-5

CITY OF EDMONTON

FORECAST OF EDMONTON POWER'S GAS REQUIREMENTS  
(BILLIONS OF CUBIC FEET)

<u>YEAR</u>	<u>ROSSDALE AND CLOVER BAR STATIONS</u> (1)	<u>ROSSDALE, CLOVER BAR AND NEW STATIONS ADDED AFTER 1979</u> (2)	<u>CAPACITY AND LOCATION OF NEW STATIONS AFTER 1979</u> (3)
1970	23.3	23.3	
1971	23.3	23.3	
1972	26.5	26.5	
1973	28.5	28.5	
1974	30.3	30.3	
1975	33.8	33.8	
1976	37.0	37.0	
1977	39.8	39.8	
1978	43.3	43.3	
1979	47.0	47.0	
1980	47.0	51.3	300 MW
1981	47.0	55.3	
1982	47.0	60.6	300 MW MEADOWLARK
1983	47.0	65.7	
1984	47.0	72.2	300 MW SITE
1985	47.0	79.0	
1986	47.0	86.9	300 MW
1987	47.0	95.2	
1988	47.0	104.3	600 MW
1989	47.0	113.9	
1990	47.0	125.3	
1991	47.0	137.4	600 MW SOUTHWEST
1992	47.0	150.3	
1993	47.0	164.8	600 MW SITE
1994	47.0	180.4	
1995	47.0	197.9	600 MW
1996	47.0	216.7	
1997	47.0	236.8	1200 MW SOUTHEAST
1998	47.0	257.6	SITE
1999	47.0	283.2	
30-YEAR REQUIREMENTS 1970 TO 1999	1,273	3,068	
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.4	9.0	



TABLE IV-6

BOARD

FORECASTS OF ALBERTA INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS  
FOR POWER GENERATION  
(BILLIONS OF CUBIC FEET)

YEAR	INDUSTRIAL			CONTINGENT			TOTAL INDUSTRIAL AND CONTINGENT (7)
	EDMONTON POWER (1)	OTHER UTILITIES (2)	TOTAL (3)	EDMONTON POWER (4)	OTHER UTILITIES (5)	TOTAL (6)	
1970	23.3	13.6	36.9	-	-	-	36.9
1971	23.3	8.8	32.1	-	1.5	1.5	33.6
1972	26.5	9.1	35.6	-	2.0	2.0	37.6
1973	28.5	10.5	39.0	-	2.5	2.5	41.5
1974	30.3	10.4	40.7	-	3.0	3.0	43.7
1975	33.8	14.3	48.1	-	3.5	3.5	51.6
1976	37.0	14.4	51.4	-	4.0	4.0	55.4
1977	39.8	14.5	54.3	-	4.5	4.5	58.8
1978	43.3	14.9	58.2	-	5.0	5.0	63.2
1979	47.0	15.4	62.4	-	5.5	5.5	67.9
1980	47.0	15.4	62.4	4.3	5.5	9.8	72.2
1981	47.0	15.4	62.4	8.3	5.5	13.8	76.2
1982	47.0	15.4	62.4	13.6	5.5	19.1	81.5
1983	47.0	15.4	62.4	18.7	5.5	24.2	86.6
1984	47.0	15.4	62.4	25.2	5.5	30.7	93.1
1985	47.0	15.4	62.4	32.0	5.5	37.5	99.9
1986	47.0	15.4	62.4	39.9	5.5	45.4	107.8
1987	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1988	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1989	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1990	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1991	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1992	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1993	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1994	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1995	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1996	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1997	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1998	47.0	15.4	62.4	48.2	5.5	53.7	116.1
1999	47.0	15.4	62.4	48.2	5.5	53.7	116.1
30-YEAR REQUIREMENTS 1970 TO 1999	1,273	434	1,707	769	142	910	2,617
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	3.0	0.4	1.8				4.0

TABLE IV-7

BOARD

FORECASTS OF ALBERTA INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS  
EXCLUDING POWER GENERATION AND PEACE RIVER  
(BILLIONS OF CUBIC FEET)

<u>YEAR</u>	<u>INDUSTRIAL</u> (1)	<u>CONTINGENT</u> (2)	<u>TOTAL INDUSTRIAL AND CONTINGENT</u> (3)
1970	91.2	-	91.2
1971	95.0	-	95.0
1972	101.6	1.0	102.6
1973	108.3	6.3	114.6
1974	115.0	10.7	125.7
1975	124.1	17.1	141.2
1976	126.9	23.6	150.5
1977	130.2	29.1	159.3
1978	133.7	29.1	162.8
1979	136.9	29.1	166.0
1980	137.0	34.0	171.0
1981	137.0	39.1	176.1
1982	137.0	44.4	181.4
1983	137.0	49.8	186.8
1984	137.0	55.4	192.4
1985	137.0	61.2	198.2
1986	137.0	67.2	204.2
1987	137.0	73.3	210.3
1988	137.0	79.6	216.6
1989	137.0	86.1	223.1
1990	137.0	92.8	229.8
1991	137.0	99.7	236.7
1992	137.0	106.8	243.8
1993	137.0	114.1	251.1
1994	137.0	121.6	258.6
1995	137.0	129.4	266.4
1996	137.0	137.4	274.4
1997	137.0	145.6	282.6
1998	137.0	154.1	291.1
1999	137.0	162.8	299.8
30- YEAR REQUIREMENTS 1970 TO 1999	3,903	2,000	5,903
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	1.4		4.2

TABLE IV-8

BOARD

FORECASTS OF ALBERTA INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS  
FOR ALL USES  
(BILLIONS OF CUBIC FEET)

<u>YEAR</u>	<u>INDUSTRIAL</u> (1)	<u>CONTINGENT</u> (2)	<u>TOTAL INDUSTRIAL AND CONTINGENT</u> (3)
1970	128.1	-	128.1
1971	127.1	1.5	128.6
1972	137.2	3.0	140.2
1973	147.3	8.8	156.1
1974	155.7	13.7	169.4
1975	172.2	20.6	192.8
1976	178.3	27.6	205.9
1977	184.5	33.6	218.1
1978	191.9	34.1	226.0
1979	199.3	34.6	233.9
1980	199.4	43.8	243.2
1981	199.4	52.9	252.3
1982	199.4	63.5	262.9
1983	199.4	74.0	273.4
1984	199.4	86.1	285.5
1985	199.4	98.7	298.1
1986	199.4	112.6	312.0
1987	199.4	127.0	326.4
1988	199.4	133.3	332.7
1989	199.4	139.8	339.2
1990	199.4	146.5	345.9
1991	199.4	153.4	352.8
1992	199.4	160.5	359.9
1993	199.4	167.8	367.2
1994	199.4	175.3	374.7
1995	199.4	183.1	382.5
1996	199.4	191.1	390.5
1997	199.4	199.3	398.7
1998	199.4	207.8	407.2
1999	199.4	216.5	415.9
30-YEAR REQUIREMENTS 1970 TO 1999	5,610	2,911	8,520
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	1.5		4.1

V OPERATING REQUIREMENTS OF GAS UTILITY COMPANIES

The operating requirements of gas utility companies have not been specifically referred to in previous assessments of Alberta requirements and were not directly referred to in the Board's Informational Letter No. IL 70-2.<sup>(1)</sup> However, in discussions with companies preparing submissions for the hearing the Board staff asked that these requirements be assessed. Most of the submissions which presented forecasts of total provincial requirements included a forecast of gas utility company operating requirements. The gas utility operating requirements include compressor fuel on utility pipe lines and at marketable gas storage reservoirs, as well as line, compressor and other losses. Gas storage is not used extensively in Alberta at present but some storage operations are carried out at fields such as Viking-Kinsella, Carbon and Bow Island.

The principal gas utility companies in the Province are Northwestern Utilities, Limited, Canadian Western Natural Gas Company Limited, Northland Utilities Limited, Plains-Western Gas and Electric Co. Ltd., Canadian Industrial Gas and Oil Limited and Albersun Oil and Gas Limited. A joint submission was received from Northwestern Utilities, Limited, (NUL) Canadian Western Natural Gas Company Limited (CWNG) and Northland Utilities Limited which together serve about two-thirds of Alberta's non-permit related requirements. The other gas utilities cooperated in providing data and discussing future requirements although

---

(1) The Informational Letter is reproduced in Appendix A.

they did not enter their own submissions.

Views of the Board Staff

The Board staff forecast that the operating requirements of the utility companies would increase from 2.2 billion cubic feet in 1969 to 7.5 billion cubic feet in 1999. It forecast total requirements for the category over the 30-year period 1970 to 1999 of 152 billion cubic feet or about 1.1 per cent of the total non-permit related Alberta requirements.

The Board staff submitted that statistical data on utility company operating requirements are difficult to obtain. The annual requirements were estimated by comparing field deliveries to the gas utilities with the sum of sales to final customers and marketable gas injection at utility company storage reservoirs. It added that the figures published in Board statistics are not always an accurate reflection of operating requirements partly because of differences in the reporting periods for field deliveries and sales to final customers. The quantities reported in the Board statistics as utility company operating requirements were compared with estimates for 1969 obtained from the utility companies. The operating requirements obtained from Board statistics were revised following this comparison and the revised numbers were expressed as a percentage of the 1969 deliveries by the particular system. In order to provide an estimate of operating requirements over the forecast period, the projections of Residential, Commercial, Industrial and Contingent



gas requirements were allocated on an annual basis to the various systems. The operating requirements of each utility company over the forecast period were then derived by applying the appropriate percentage to the projected annual deliveries of the system. The staff noted that changes in percentage requirements may occur on individual systems as the load changes and facility modifications occur, or as the delivery pressure of fields supplying the system declines.

#### Views of Consolidated

Consolidated stated at the hearing that its own staff rather than that of Hedlin Menzies & Associates Ltd. (Hedlin Menzies), prepared the part of its submission pertaining to the utility company operating requirements. Consolidated estimated the operating requirements of Alberta gas utilities at 130.5 billion cubic feet over the 30-year period 1970 to 1999. It submitted that, from the experience of major Alberta utility companies, these requirements amount to about 1 per cent of the volumes delivered to the gas utilities' consumers in Alberta. Consolidated therefore applied this percentage to the annual sum of projected Residential, Commercial, Industrial and Contingent gas requirements of Alberta to obtain the annual operating requirements of the gas utilities in future years.

#### Views of Alberta & Southern and TransCanada

Foster Economic Consultants Ltd. (Foster), which prepared the submission for Alberta & Southern and TransCanada, stated that it had projected the operating requirements of gas

utilities as 1 per cent of projected sales of Alberta gas utilities. It indicated that the projected operating requirements amounted to 111 billion cubic feet over the 30-year period 1970 to 1999.

Mr. Hurd, a witness for the intervener, in testifying at the hearing respecting future gas requirements generally, stated that there are several large fields close to Alberta load centres that will be available as storage reservoirs in the latter part of the 30-year period. He agreed that additional use of storage reservoirs would tend to increase somewhat the requirements for compression.

#### Views of the Combined Utilities

The Combined Utilities estimated that the gas utility operating requirements would approximate 1 per cent of sales by the gas utilities, based on recent experience within the CWNG and NUL service areas. They acknowledged at the hearing that there will be some tendency in the future to use gas for Alberta requirements from fields more remote than those which are now their supply fields. They agreed that gas storage will be used to an increasing extent in the future, particularly on the Canadian Western system. The Combined Utilities further agreed that these two trends would tend to increase the gas needed for utility operating requirements above the historical figure of 1 per cent.

Views of the Board

The Board observes that the estimates of the operating requirements of Alberta gas utilities were based mainly on the experience of NUL and CWNG. It notes that in the past these requirements have amounted to about 1 per cent of the gas sales by these utilities. The Board recognizes that the gas utility operating requirements as a percentage of gas sales are likely to increase slightly, particularly in the latter part of the forecast period, with the requirements being supplied partly from more remote fields and with greater use being made of gas storage, as acknowledged by the utility companies and Alberta & Southern and TransCanada. However, the Board recognizes that these requirements will remain small relative to total Alberta gas requirements. The Board therefore adopts 1.1 per cent of the projected sales of Alberta gas utilities as the operating requirements of the gas utilities during the forecast period. On this basis utility company operating requirements are estimated to increase from 2.6 billion cubic feet in 1970 to 7.0 billion cubic feet in 1999 and to total 149 billion cubic feet over the 30-year period, as shown in Table V-1.

TABLE V-1

BOARD

FORECAST OF OPERATING REQUIREMENTS OF GAS UTILITY COMPANIES  
(BILLIONS OF CUBIC FEET)

<u>YEAR</u>	<u>RESIDENTIAL, COMMERCIAL, INDUSTRIAL &amp; CONTINGENT REQUIREMENTS</u> (1)	<u>OPERATING REQUIREMENTS OF GAS UTILITY COMPANIES</u> (2)
1970	237.2	2.6
1971	241.1	2.7
1972	256.0	2.8
1973	275.4	3.0
1974	292.3	3.2
1975	320.4	3.5
1976	337.4	3.7
1977	353.5	3.9
1978	365.4	4.0
1979	377.4	4.2
1980	391.0	4.3
1981	404.2	4.5
1982	418.8	4.6
1983	433.3	4.8
1984	449.4	4.9
1985	466.4	5.1
1986	484.4	5.3
1987	503.0	5.5
1988	513.5	5.7
1989	524.1	5.8
1990	534.9	5.9
1991	546.0	6.0
1992	557.3	6.1
1993	568.7	6.3
1994	580.3	6.4
1995	591.3	6.5
1996	602.6	6.6
1997	614.1	6.8
1998	626.0	6.9
1999	637.9	7.0
30-YEAR REQUIREMENTS 1970 TO 1999	13,503	149

## VI PERMIT RELATED GAS REQUIREMENTS

This section deals with the Alberta requirements related to the removal of gas from the Province under existing permits. The requirement category was referred to in Informational Letter No. IL 70-2<sup>(1)</sup> as 'other' industrial requirements.

The Province's permit related gas requirements generally comprise the difference between the marketable gas receipts and marketable gas deliveries of main pipe lines and the plants which reprocess marketable gas. The requirements consist principally of the following:

- (a) shrinkage due to extraction of constituents other than methane at marketable gas reprocessing plants, and the plant fuel associated with the extraction of the products.
- (b) compressor fuel requirements of the pipe lines operated by Trunk Line.
- (c) line losses of Trunk Line.

### Views of Trunk Line

Trunk Line estimated its gas requirements for the period, January 1, 1970 to December 31, 1999 to be 478 billion cubic feet measured at standard conditions, or 508 billion cubic feet on a 1000 Btu per cubic foot equivalent basis. These requirements are for fuel and line losses. The gas used as fuel includes compressor fuel and heating fuel for compressor and

---

(1) The Informational Letter is reproduced in Appendix A.



Consolidated has a permit to remove gas from the Province at Empress and that it was expected that this gas would be reprocessed by one of the plants at Empress. In its forecast of Alberta gas requirements, the staff made allowance for the requirements of the Empress plants related to the TransCanada permit<sup>(2)</sup> as well as requirements for the reprocessing of gas approved for removal from the Province under Permit No. CNG 69-1, the Consolidated permit.

The Board staff submitted that requirements related to gas reprocessing plants amounted to 36.6 billion cubic feet in 1969 and would likely increase to a maximum of 78 billion cubic feet in 1981 and remain at approximately this level until 1986. Based on volumes of gas approved for removal from the Province at the time of the submission, the requirements were expected to decline in 1986 and subsequent years, as the deliverability of fields supplying some permits declines and the permits terminate at various dates towards the end of the 30-year period, 1970 to 1999. On this basis, the staff estimated that the requirements for all gas reprocessing plants over the 30-year period would total some 1,620 billion cubic feet. The staff considered it likely that, following applications from permittees during the 30-year period 1970 to 1999, subsisting

---

(2) The staff based its forecast on the volumes authorized in this permit and the additional volumes applied for by TransCanada in an application heard before the Board on March 4, 1970.

permits will be amended to increase the volume of gas which may be removed from the Province. However, since the assessment of the gas surplus is based on permits now in effect, no allowance was made for additional permit authorizations.

The Board staff acknowledged that the shrinkage losses during the 30-year period 1970 to 1999 would depend on the time new reprocessing plants went into operation, the analyses of the gas being processed and the products extracted. It agreed there was considerable uncertainty as to what the analyses would be. However, it noted that if the gas being reprocessed became leaner, the changes would reduce the marketable gas reserves of the fields being produced to the plants, as well as the plant requirements. This follows, since the reserves of the fields are estimated as the marketable gas reserves following field processing.

## (2) Trunk Line Requirements

The Board staff submitted that the requirements of Trunk Line for the 30-year period 1970 to 1999 would be some 508 billion cubic feet. These requirements are mainly related to the transmission of gas authorized to be removed from the Province from the fields of origin to the delivery points at the Alberta borders. In the staff submission, the principal permits for which gas would be transported by Trunk Line were given as Permit No. TC 69-9, Permit No. AS 69-5, including the amendment dated January 29, 1970, Permit No. WC 62-5 and Permit No. CNG 69-1. The TransCanada permit volume considered

in the forecast included the additional volumes applied for in the application heard by the Board at a hearing on March 4, 1970 and reported on in OGCB Report 70-B<sup>(3)</sup>.

The Board staff projected Trunk Line requirements to increase from some 13 billion cubic feet in 1969 to some 30 billion cubic feet in 1980. Thereafter, the requirements were projected to decline in a manner similar to reprocessing plant requirements, as permits approach the termination dates and eventually expire.

#### Views of Consolidated

Consolidated's submission stated that the permit related requirements of reprocessing plants and Trunk Line in Alberta would increase from some 63 billion cubic feet in 1970 to some 112 billion cubic feet in 1982 and then decline to some 4 billion cubic feet in 1999. The total requirements for the 30-year period 1970 to 1999 were estimated to be 2,131 billion cubic feet. Consolidated's forecast of permit related industrial requirements is set forth in column (2) of Table VI-1.

#### (1) Reprocessing Plant Requirements

Consolidated submitted that the 30-year requirements of the reprocessing plants would be as follows:

---

(3) In the Matter of an Application of Trans-Canada Pipe Lines Limited under The Gas Resources Preservation Act, 1956. 1970.

<u>Plant</u>	<u>Percentage Inlet Volume</u>	<u>30-Year Requirements 1970 to 1999 ( Bcf of 1000 Btu Equivalent)</u>	<u>On Stream Date</u>
Pacific Empress	2.88	762	In Operation
Dome-TransCanada Empress	2.65	409	Jan. 1, 1972
Alberta Natural Gas Cochrane	2.66	406	Unspecified
Edmonton Liquid Gas	3.83	<u>115</u>	In Operation
	Total	1,692	

Consolidated estimated that 97 per cent of the gas which TransCanada is now authorized to remove from the Province, plus the volumes authorized for removal by Consolidated, less the volume processed at the Pacific Plant, would be processed by the Dome-TransCanada Empress Plant. However, it was acknowledged that Consolidated had not entered into any contracts for reprocessing the gas it has under permit at either of the Empress Plants.

The volume of gas processed at the Cochrane Plant was taken as those volumes that Alberta and Southern was authorized to remove from the Province at the time of the hearing, less the volumes Alberta and Southern estimated would be produced in the Waterton and Wildcat Hills Fields.

Consolidated recognized that there was some uncertainty in its forecasts of reprocessing plant requirements. Mr. Lashuk, witness for Consolidated, agreed that the Dome-TransCanada Plant at Empress utilizes a process which may permit ethane to be recovered economically if a market develops for ethane, and that such recovery would increase the plant requirements.

(2) Trunk Line Requirements

Consolidated submitted that the percentage of gas used by Trunk Line as fuel, and the unaccounted for losses, increased with throughput from 0.67 per cent when 700 billion cubic feet was being handled annually, to 0.97 per cent at 820 billion cubic feet and 1.22 per cent at 985 billion cubic feet. It therefore estimated Trunk Line's future requirements by forecasting future deliveries under existing and applied for permits and relating gas requirements to the anticipated deliveries. On this basis it estimated Trunk Line's future requirements to be 438 billion cubic feet over the 30-year period 1970 to 1999.

Views of Alberta & Southern and TransCanada

In the study prepared by Foster Economic Consultants Ltd. (Foster) for Alberta & Southern and TransCanada, permit related requirements were estimated to increase from some 50 billion cubic feet in 1969 and 70 billion cubic feet in 1970 to some 107 billion cubic feet in 1981, and to decrease thereafter to some 2 billion cubic feet in 1999. Foster estimated the total permit related requirements over the 30-year period 1970 to 1999 to be some 1,868 billion cubic feet<sup>(4)</sup>. Its forecast is shown in column (3) of Table VI-1.

(1) Reprocessing Plant Requirements

Foster submitted supplementary information at the hearing

---

(4) Adjusted at the hearing from 1,832 billion cubic feet in consideration of the heating value of Trunk Line and Alberta Natural Gas Cochrane plant gas requirement volumes.



which indicated that its estimate of reprocessing plant requirements for the 30-year period was 1,360 billion cubic feet<sup>(5)</sup>. The estimate is exclusive of any reprocessing plant requirements at the Empress plants of Dome-TransCanada and Pacific after 1987, the year in which Pacific's propane removal permit and its agreement with TransCanada respecting volumes to be processed terminate. Moreover, Foster did not include in its estimates the 93 billion cubic feet of reprocessing plant requirements which it believed may arise in connection with the gas which is authorized for removal by Consolidated. This omission was made because Foster was not aware of any contracts for the reprocessing of the gas.

#### (2) Trunk Line Requirements

Foster submitted that Trunk Line's requirements would total some 507 billion cubic feet on a 1000 Btu per cubic foot equivalent basis for the 30-year period 1970 to 1999. The requirements were forecast to increase from some 19 billion cubic feet in 1970 to 30 billion cubic feet in 1981 and then to decline, ceasing entirely in 1995 at the termination of the permits for the removal of gas from the Province.

#### Views of Pacific

Pacific presented a forecast of the processing shrinkage and fuel consumption which will occur at the reprocessing plant

---

(5) Adjusted from 1,356 billion cubic feet in consideration of the heating value of Alberta Natural Gas Cochrane plant gas requirement volumes.

it operates at Empress. It submitted that the total requirements would amount to 516 billion cubic feet over the period from 1970 to the end of its agreement with TransCanada on October 31, 1987. The forecast of requirements is shown in column (1) of Table VI-2. These requirements comprise 77 billion cubic feet for plant fuel and 439 billion cubic feet for processing shrinkage associated with the removal of some 80 per cent of the propane, and essentially all butanes and pentanes plus, from the gas stream.

Pacific stated that in its forecast it used a lower percentage requirement, 5.2 per cent, for its plant in terms of Btu throughput than it has experienced in the operation of the plant in 1969, when the percentage was 6.0 per cent. The lower requirement rate during the forecast was chosen on the assumption that the gas delivered to the plant will become leaner. This assumption was based on a review of field plant modifications which were either under way or planned. The leaner gas has the effect of reducing fuel requirements in addition to reducing the shrinkage requirements. Pacific also stated that the percentage of the natural gas liquids recovered was not affected by the level of utilization of the plant's capacity.

#### Views of the Board

The Board's assessment of the permit related requirements associated with the transportation and reprocessing of gas to be removed from the Province under permits existing or applied for at the time of the hearing has been based on an examination of

the estimates and supporting evidence submitted by the interveners, the historical requirements of the existing facilities, the nature of facilities under construction and the deliveries anticipated over the forecast period. The Board's estimates of 30-year totals for the various components of permit related requirements are compared to the estimates submitted by the interveners in Table VI-2. The Board's estimates are set forth on an annual basis in Table VI-3. As shown in column (7) of the Table, the requirements for all the components are estimated to increase from 65 billion cubic feet in 1970, to some 114 billion cubic feet in 1981 and then to decrease to some 2 billion cubic feet in 1999. The annual requirements shown in column (7) of the Table result in 30-year requirements over the period 1970 to 1999 of 2,116 billion cubic feet.

(1) Reprocessing Plant Requirements

The Board notes that, in discussing the future requirements of gas reprocessing plants, a number of interveners referred to possible changes in field processing facilities. Such changes may have an impact not only on the analysis of the input gas to the reprocessing plants, but also on the estimated reserves of the fields supplying the plants. In assessing the reserves of the fields, the Board bases its estimates on existing field plant facilities and the facility modifications and additions it has already approved, or respecting which it has received applications where the applications are likely to lead to approvals. Therefore, in considering applications for the

removal of gas from the Province, the Board believes the reprocessing plant requirements should be estimated on the basis of similar assumptions.

The Board's views respecting the future gas requirements of each of the reprocessing plants and the reprocessing requirements expected in connection with removal of gas under the Consolidated permit are discussed in more detail below.

Pacific Empress Plant. The Board staff estimated the requirements of the plant over the 30-year period 1970 to 1999 to be 530 billion cubic feet. However, in the Board's view, the staff's estimate assumed that an unreasonably large portion of the gas under permit to TransCanada would be processed at the Dome-TransCanada plant relative to the portion allocated to the Pacific Plant. The Board understands that, under the current contract between TransCanada and Pacific, Pacific has the opportunity to process up to 1.5 billion cubic feet of gas per stream day for as long as such volumes are available during the period ending October 31, 1987. The Board believes it is reasonable to assume that, with some allowance for plant turn around and other interruptions, the actual volumes processed at the plant will be 538 billion cubic feet per year until 1988, when decline in field deliverability results in declining volumes being available. These volumes reduce with the deliverability of permit fields from 538 billion cubic feet in 1987 to 187 billion cubic feet at the termination of TransCanada's permit in 1994.

Pacific and Foster did not make any allowance for requirements

related to reprocessing at the plant following the expiration of the agreement between Pacific and TransCanada and the termination of Pacific's propane removal permit on October 31, 1987. The Board believes that, since there are likely to be markets for the natural gas liquids either within or outside Alberta following the termination of the propane removal permits, it is likely that a new agreement will be made between TransCanada and Pacific, or another plant owner, and that it is proper to continue reprocessing plant requirements for the gas volumes which will be available for reprocessing at Empress between 1987 and the termination of TransCanada's gas removal permit. In the Board's view some 130 billion cubic feet of reprocessing plant requirements can reasonably be expected at this plant or another plant between 1987 and the expiration of TransCanada's permit in 1994. On this basis the total requirements of the processing plant over the 30-year period 1970 to 1999 are estimated to be 665 billion cubic feet or some 5.3 per cent of the forecast inlet volumes to the plant on a 1000 Btu per cubic foot equivalent basis.

Dome-TransCanada Empress Plant. The Board believes that the reprocessing plant requirements forecast for this plant by Foster as 358 billion cubic feet, or some 5.6 per cent of the inlet gas volume on a 1000 Btu per cubic foot equivalent basis, are reasonable having regard for the process employed at the plant and the experience at the Pacific Empress plant, where the corresponding percentage is 5.3. A schedule of annual requirements



was developed by assuming that the gas processed at the plant would comprise the difference between the volumes delivered for TransCanada at Empress and the volumes contracted for processing to Pacific. The estimate of 358 billion cubic feet adopted by the Board is some 50 billion cubic feet less than Consolidated's estimate for the processing of gas under TransCanada's permit. However, Consolidated's estimate appears to include an allowance for the processing of some gas approved for removal from the Province under its own permit. The Board staff estimate of 505 billion cubic feet is higher for the reasons discussed above with respect to the Pacific Empress plant.

Alberta Natural Gas Cochrane Plant. The Board notes that this plant began operations in 1970 and that the estimates of the plant's 30-year requirements by the Board staff, Foster, and Consolidated are all in the order of 400 billion cubic feet. This represents about 6 per cent of the projected plant inlet volume on a 1000 Btu per cubic foot equivalent basis. The Board considers this a reasonable estimate of the requirements and accepts it for the 30-year period 1970 to 1999.

Edmonton Liquid Gas Plant. The Board recognizes that the requirements of this plant are only partly related to permits for the removal of gas from the Province. However, having regard for the amount of the requirements, the Board has for convenience, treated the total plant requirements as permit related requirements.

Foster and the Board staff estimated the plant's requirements

to total 69 billion cubic feet over the 30-year period 1970 to 1999. This estimate amounts to some 7.7 per cent of the inlet gas to the plant on a 1000 Btu per cubic foot equivalent basis. Consolidated's estimate of the plant's 30-year requirements was 115 billion cubic feet. The Board concludes from a review of past gas requirements of the plant and projected throughput volumes, that 69 billion cubic feet is a reasonable estimate of future requirements.

Requirements Related to Reprocessing of Consolidated's

Permit Volumes. The Board agrees that it is reasonable to assume that gas removed from the Province at Empress pursuant to the permit held by Consolidated will be processed at one of the existing reprocessing plants. Further, Consolidated's submission made allowance for the Alberta requirements associated with reprocessing of this gas. Having regard for the analysis of the gas to be removed and the projected requirements of the Empress reprocessing plants, the Board believes that an amount of gas equivalent to some 6 per cent of the gas included in the permit on a 1000 Btu per cubic foot equivalent basis will be removed or utilized at a reprocessing plant. On this basis, the Board's estimate of 30-year requirements is 116 billion cubic feet, as compared to Foster's estimate of 93 billion cubic feet. Since Consolidated's submission grouped together the requirements for reprocessing TransCanada gas and the gas to be removed under its own permit, it is not precisely apparent from the submission what portion was attributed to the latter permit.

Summary of Reprocessing Plant Requirements. The Board forecasts that the reprocessing plant requirements for the 30-year period will amount to 2,116 billion cubic feet. This compares to some 2,130 billion cubic feet estimated by the Board staff and Consolidated and 1,870 billion cubic feet estimated by Foster.

Trunk Line Requirements. The estimates of Trunk Line requirements over the 30-year period range from some 438 billion cubic feet, submitted by Consolidated, to some 508 billion cubic feet, submitted by Trunk Line itself. Foster and the Board staff accepted Trunk Line's estimates in their forecasts.

The Board believes that the analysis submitted by Trunk Line in which it considered in detail the manner in which it will accommodate load additions approved or applied for at the time of the submission, provides the most reasonable estimate of the requirements. Accordingly, the Board accepts Trunk Line's estimates of annual requirements which with adjustments for heating value and other minor adjustments, increase from some 19 billion cubic feet in 1970 to a maximum of some 30 billion cubic feet in 1981. As the deliverability of fields included in permits declines and the permits terminate, Trunk Line's annual requirements decline and are expected to be reduced to zero in 1996. On this basis, the 30-year requirements amount to 508 billion cubic feet.

TABLE VI-1

FORECASTS OF  
ALBERTA PERMIT RELATED GAS REQUIREMENTS  
(BILLIONS OF CUBIC FEET)

YEAR	BOARD STAFF* (1)	CONSOLIDATED (2)	ALBERTA & SOUTHERN AND TRANSCANADA** (FOSTER) (3)	BOARD (4)
1970	70.8	63.1	69.6	65.3
1971	91.2	79.0	85.9	87.3
1972	103.7	109.4	96.1	103.2
1973	106.2	111.0	102.7	110.0
1974	106.2	111.0	102.7	110.0
1975	106.8	111.0	104.6	111.8
1976	107.8	111.0	105.7	112.9
1977	107.7	111.1	105.8	113.0
1978	107.7	111.1	105.8	113.0
1979	107.9	111.0	106.3	113.5
1980	108.0	111.1	106.7	113.9
1981	108.1	111.3	106.8	114.1
1982	107.1	112.4	105.9	113.1
1983	104.8	107.7	99.8	106.9
1984	101.1	100.5	90.6	97.3
1985	99.4	96.0	85.3	91.9
1986	90.0	90.2	71.0	77.5
1987	78.7	84.5	54.5	66.9
1988	53.2	78.2	25.8	60.3
1989	50.8	70.9	23.6	53.0
1990	43.5	43.1	16.6	42.0
1991	42.5	25.2	15.6	37.8
1992	42.0	22.7	15.2	35.1
1993	39.6	19.4	12.9	30.1
1994	26.4	9.6	4.1	19.2
1995	7.2	3.8	2.5	7.2
1996	2.3	3.8	2.3	2.3
1997	2.3	3.8	2.4	2.3
1998	2.3	3.8	2.4	2.3
1999	2.3	3.8	2.4	2.3
30-YEAR REQUIREMENTS 1970 TO 1999	2,128	2,131	1,832***	2,116

\* REVISED DATA. THE INTERVENER ADJUSTED ITS ORIGINAL FORECAST AT THE HEARING TO REFLECT ADDITIONAL INFORMATION RELATED TO PACIFIC'S EMPRESS PLANT.

\*\* EXCLUDES REQUIREMENTS ASSOCIATED WITH REPROCESSING OF VOLUMES UNDER PERMIT TO CONSOLIDATED.

\*\*\* INCREASED AT THE HEARING TO 1,868 BILLION CUBIC FEET AS A RESULT OF HEATING VALUE ADJUSTMENTS TO TRUNK LINE AND ALBERTA NATURAL GAS COCHRANE PLANT REQUIREMENTS.

TABLE VI-2

DETAILED COMPARISON OF FORECASTS OF  
ALBERTA PERMIT RELATED GAS REQUIREMENTS\*  
(BILLIONS OF CUBIC FEET)

INTERVENER	PACIFIC EMPRESS PLANT (1)	DOME- TRANSCANADA EMPRESS PLANT (2)	CONSOLIDATED PERMIT NO. CNG 69-1 (3)	ALBERTA NATURAL GAS COCHRANE PLANT (4)	EDMONTON LIQUID GAS PLANT (5)	TRUNK LINE (6)	TOTAL (7)
BOARD STAFF	530	505	116	400	69	508	2,128
CONSOLIDATED	762**	409**	-	406	115	438	2,130
ALBERTA & SOUTHERN AND TRANSCANADA	531	358	-	403	69	507	1,863
PACIFIC***	516	-	-	-	-	-	-
TRUNK LINE***	-	-	-	-	-	508	-
BOARD	665	358	116	400	69	508	2,116

\* 30-YEAR TOTALS, 1970 TO 1999

\*\* INCLUDES REPROCESSING REQUIREMENTS RESPECTING THE CONSOLIDATED PERMIT, PERMIT NO. CNG 69-1.

\*\*\* ESTIMATES SUBMITTED FOR OWN OPERATIONS ONLY.



TABLE VI-3

BOARD							
FORECASTS OF ALBERTA PERMIT RELATED GAS REQUIREMENTS (BILLIONS OF CUBIC FEET)							
YEAR	PACIFIC EMPRESS (1)	DOME EMPRESS (2)	ALBERTA NATURAL GAS COCHRANE (3)	EDMONTON LIQUID GAS (4)	CONSOLIDATED (5)	TRUNK LINE (6)	TOTAL (7)
1970	29.8	-	14.0	2.3	-	19.2	65.3
1971	29.8	6.2	19.8	2.3	4.6	24.6	87.3
1972	29.8	20.7	19.8	2.3	4.8	25.8	103.2
1973	29.8	25.0	19.8	2.3	4.8	28.3	110.0
1974	29.8	25.0	19.8	2.3	4.8	28.3	110.0
1975	29.8	26.2	19.8	2.3	4.7	29.0	111.8
1976	29.8	26.4	19.8	2.3	4.6	30.0	112.9
1977	29.8	26.5	19.8	2.3	4.6	30.0	113.0
1978	29.8	26.5	19.8	2.3	4.6	30.0	113.0
1979	29.8	26.8	19.8	2.3	4.6	30.2	113.5
1980	29.8	27.2	19.8	2.3	4.6	30.2	113.9
1981	29.8	27.2	19.8	2.3	4.6	30.4	114.1
1982	29.8	27.2	19.8	2.3	4.6	29.4	113.1
1983	29.8	23.3	19.8	2.3	4.6	27.1	106.9
1984	29.8	17.5	19.8	2.3	4.6	23.3	97.3
1985	29.8	13.7	19.8	2.3	4.6	21.7	91.9
1986	29.8	8.8	13.2	2.3	4.6	18.8	77.5
1987	29.8	3.8	13.2	2.3	4.6	13.2	66.9
1988	29.1	-	13.2	2.3	4.6	11.1	60.3
1989	24.2	-	13.2	2.3	4.6	8.7	53.0
1990	20.4	-	9.3	2.3	4.6	5.4	42.0
1991	17.3	-	9.3	2.3	4.6	4.3	37.8
1992	15.1	-	9.3	2.3	4.6	3.8	35.1
1993	12.5	-	7.9	2.3	4.6	2.8	30.1
1994	10.3	-	-	2.3	4.6	2.0	19.2
1995	-	-	-	2.3	4.6	0.3	7.2
1996	-	-	-	2.3	-	-	2.3
1997	-	-	-	2.3	-	-	2.3
1998	-	-	-	2.3	-	-	2.3
1999	-	-	-	2.3	-	-	2.3
30-YEAR REQUIREMENTS 1970 TO 1999	665	358	400	69	116	508	2,116

## VII PEAK DAY REQUIREMENTS

The Board indicated in Informational Letter No. IL 70-2<sup>(1)</sup> that the scope of the gas requirements hearing would include consideration of the 30th year peak day requirements. Submissions respecting the 30th year peak day requirements were received from Consolidated, Alberta & Southern and TransCanada, the Combined Utilities and the City of Edmonton. The Consolidated submission was prepared by Hedlin Menzies & Associates Ltd. (Hedlin Menzies) and the joint submission of Alberta & Southern and TransCanada was prepared by Foster Economic Consultants Ltd. (Foster). The City of Edmonton in its submission commented on the peak day requirements of its Edmonton Power electrical utility only.

The interveners making submissions on peak day requirements based their submissions to a considerable extent on data obtained from the Combined Utilities. Since the data available from the Combined Utilities were grouped on a different basis than the remaining requirements data, the Combined Utilities and the other interveners found it convenient to present the peak day requirements evidence on this different basis. The different data grouping is retained in this section.

Normally, in determining peak day requirements, the load factor of each requirement category is considered. The load factor in a particular year is the ratio of the average day requirements to the peak day requirements. Having estimated the

---

(1) The Informational Letter is reproduced in Appendix A.

annual requirements and the load factor, the peak day requirements are determined by dividing the annual requirements by the product of 365 and the load factor determined for the particular year.

#### Views of Consolidated

Hedlin Menzies estimated that in 1999 the gas demand load factor would be 57.7 per cent and the peak day demand 3.30 billion cubic feet. It submitted that the load factor of the systems operated by Canadian Western Natural Gas Company Limited (CWNG) and Northwestern Utilities, Limited (NUL) was 51.5 per cent in 1969. Hedlin Menzies interpreted the Alberta Residential-Commercial load factor to be 35 per cent and the Industrial load factor, including thermal electric demand, to be 80 per cent. Applying these load factors to 1969 Alberta gas sales, Hedlin Menzies estimated the 1969 total provincial load factor to be 50.6 per cent.

Hedlin Menzies forecast the 30th year peak day requirements for Alberta by applying a 35 per cent load factor to the Residential and Commercial sectors and an 80 per cent load factor to the Industrial and Thermal categories.<sup>(2)</sup> It projected the Industrial demand for gas to increase at a faster rate than the demand for gas in the Residential and Commercial sectors. Hence, application

---

(2) The terms Industrial and Thermal, as used in this context, embrace the categories designated by the Board as Industrial and Contingent gas requirements, the Operating requirements of gas utility companies and Permit Related gas requirements.

of its estimates of load factors to its forecasts of demand in these categories yielded an improved load factor of 57.7 per cent in 1999. Using this load factor and its estimates of 1999 gas demand, it forecast the 1999 peak day demand to be 3.30 billion cubic feet.

Hedlin Menzies agreed that if gas were used increasingly for peaking purposes in thermal generating stations in the latter part of the 30-year period 1970 to 1999, as was expected to be the case, this would tend to decrease the gas demand load factor. It further agreed that some adjustment should be made to its forecast 1999 gas demand load factor to take account of this trend.

#### Views of Alberta & Southern and TransCanada

Foster estimated that in 1999 the gas demand load factor would be 64.3 per cent and the peak day demand 2.64 billion cubic feet.

It estimated the 30th year peak day requirements by

- (a) obtaining 1969 load factors for each gas utility serving customers in Alberta and for the various segments of the Permit Related category;
- (b) calculating the weighted average 1969 load factor; and
- (c) assessing the portion that the Residential-Commercial load is to the total load in 1969 and 1999, and after concluding that the portion will remain constant, using the 1969 load factor with its projection of 1999 sales to calculate the 1999 peak day requirements.

The load factors estimated by Foster for 1969 were as follows:

System	Annual Gas Sales (Bcf)	Load Factor (Per Cent)
CWNG	71.4	48.8
NUL	96.3	53.5
Canadian Industrial Gas	40.2	85.0
City of Medicine Hat	6.7	55.0
Other Utilities	10.8	53.5
Unidentified Companies		
Industrial	9.0	85.0
Permit Related and gas utility Company Operating requirements	<u>51.6</u>	<u>90.0</u>
	286.0	64.3

Extensive historical data were available to Foster for the CWNG and NUL systems only. Hence, in assessing whether any change in the load factor was likely, Foster confined its analysis to data from these utilities. The analysis indicated that the combined load factor of the two systems over the period 1957 to 1969 averaged 50 per cent with annual variations from the average of only 10 per cent in most years. Foster noted that the two systems accounted for some 60 per cent of total Provincial gas requirements in 1969. In view of the stability of historical load factors on the two systems, and also because Residential-Commercial requirements were projected to account for a constant percentage of total Provincial gas requirements, Foster concluded that it was reasonable to use the 1969 average Provincial load factor of 64.3 per cent to determine peak day requirements in 1999.

Foster noted that if the Permit Related requirements were



to remain at a high level in 1999, there would be an additional demand of 104 billion cubic feet. At a 90 per cent load factor these additional requirements would result in a somewhat greater average load factor for the Province of 68.0 per cent.

Foster acknowledged that if gas were used increasingly as a peaking fuel for power generation in the latter part of the 30-year period this might tend to lower the load factor for gas. However, Foster expressed the belief that, all things considered, the values it had quoted for load factors were appropriate.

#### Views of the Combined Utilities

The Combined Utilities forecast that in 1999, for those Alberta requirements not related to the removal of gas from the Province, the load factor would be 55.7 per cent and the peak day demand 3.57 billion cubic feet.

They submitted that they had calculated the potential peak day load factor for Residential, Commercial and Basic Industrial requirements based on the most severe conditions of low temperature accompanied by high wind likely to be experienced on the CWNG and NUL systems. The suitability of this theoretically derived load factor was confirmed by experience during days when conditions approximating the assumed extreme conditions were experienced. The resulting load factor of 35.2 per cent for the above three categories was expected to remain unchanged over the forecast period. Data available for the Special Industrial<sup>(3)</sup>

---

(3) Excluding Edmonton Power.

category indicated to the Combined Utilities that a load factor of 80.4 per cent was appropriate for this category. Edmonton Power's current load factor, which is held to 87.5 per cent by peak shaving with oil, was assumed to apply throughout the 30-year period. A load factor of 85 per cent was assumed for the projected requirements of Peace River Mining & Smelting Ltd. (Peace River) and also for the Contingency Allowance. Using these load factors and the consumption expected in each category in 1999, the Combined Utilities estimated a weighted average load factor for the Province in 1999 of 55.7 per cent. This load factor does not take account of the requirements of Trunk Line and the gas reprocessing plants.

In commenting on their estimates, the Combined Utilities stated that industrial users could be expected to employ peak shaving devices to maintain good load factors during the forecast period, in view of the price advantages associated with this practice.

The Combined Utilities' forecast of the 1999 load factors and requirements is summarized below:

<u>Requirement Category</u>	<u>Annual Requirements (Bcf)</u>	<u>Load Factor (Per Cent)</u>	<u>Peak Day Requirements (Bcf)</u>
Residential, Commercial and Basic Industrial	265.7	35.2	2.068
Special Industrial (Excluding Edmonton Power)	130.9	80.4	0.446
Edmonton Power	47.0	87.5	0.147
Contingency (Excluding Peace River)	140.0	85.0	0.451
Peace River	<u>142.0</u>	85.0	<u>0.458</u>
	725.6	55.7	3.570

### Views of the City of Edmonton

The City of Edmonton did not comment on the peak day gas requirements of the Province as a whole but included in its submission information on the requirements of its electric utility's power generation facilities.

The City's electric power utility, Edmonton Power, currently maintains its gas demand load factor at 87.5 per cent by using fuel oil for peak shaving purposes. The Edmonton Power electrical demand load factor is now about 50 per cent and the City projected that it would increase to 62 per cent by 1999. It expected that gas would be used as the main fuel for its generating stations, with fuel oil supplying less than 1 per cent of the load requirements after 1972. According to the City's submission, the older generating units would be used for peaking purposes, employing gas as the principal fuel. On this basis, the City anticipated gas requirements for power generation of 283 billion cubic feet in the year 1999, with a peak day requirement of 1.1 billion cubic feet corresponding to a load factor of 70 per cent.

### Views of the Board

After reviewing the evidence, the Board concludes that in 1999 the gas demand load factor of the Province will be 51 per cent and the corresponding peak day requirements 3.45 billion cubic feet. The principal factors used in the calculation are summarized in Table VII-I.

The Board notes that the load factor for combined Residential, Commercial and Basic Industrial requirements has remained

reasonably constant at 35 per cent. The Board accepts the view that a 35 per cent load factor should be used in estimating peak day requirements for this group in 1999. However, since the Board has not prepared a separate forecast of Basic Industrial requirements, and since the Basic Industrial requirements are unlikely to be large relative to Residential and Commercial requirements, the Board has applied the 35 per cent load factor to its estimates of 1999 Residential and Commercial requirements only.

The Board believes that the load factor for gas required for Power Generation deserves careful consideration in view of the wide variation in the estimates of demand in this category in the 30th year of the forecast period and the uncertainties respecting the fuel to be used in generating facilities which will accommodate the peaks in demand. Considerable evidence was entered by the City of Edmonton on this matter. Having regard for the large portion of the Alberta gas demand for thermal Power Generation which Edmonton's requirements comprise, the Board believes that a load factor determined for Edmonton Power is likely to be applicable to gas requirements for Power Generation throughout the Province.

The Board notes that Edmonton Power currently maintains its gas demand load factor at 87.5 per cent by using fuel oil for peak load requirements (peak shaving). In the absence of peak shaving with fuel oil, the gas demand load factor would be about 50 per cent. The Board notes that the City of Edmonton

expects its electrical demand load factor to improve from about 50 per cent at present to 62 per cent in 1999, based on a projection of its previous experience and the experience of other utilities. The Board also observes that the City expects to utilize its older generating units, which are mainly gas-fired, for peaking purposes in the latter part of the forecast period. The Board further notes that Edmonton Power estimated its gas demand load factor in 1999 as 70 per cent on the assumption that gas would be used as the principal fuel for its generating facilities at that time.

The Board finds that although the Combined Utilities, Hedlin Menzies and Foster assumed continuation of a gas demand load factor of 87.5 per cent for Edmonton Power, Hedlin Menzies, and to some extent Foster, recognized that there would be increasing incentives to use gas as a peaking fuel rather than as a base load fuel. The Board believes that, with the lower investment required for gas-fired stations and the proximity of reservoirs suitable for supplying peaking gas in the Edmonton Area, there will likely be incentives for using gas as a fuel for peaking purposes in 1999. These incentives suggest to the Board that there will be increasing use of gas for peaking purposes, particularly in the latter part of the 30-year period, 1970 to 1999.

The Board in Section IV adopted a level of gas requirements for Edmonton Power in 1999 amounting to about 34 per cent of the forecast by the City of Edmonton. The Board expressed



general agreement with the growth which the City projected for the power load requirements. Having regard for these conclusions and the incentives for utilizing gas as a fuel for peaking purposes, the Board believes that the gas demand load factor for Edmonton Power, and for thermal use in the Province generally, will be lower than the 70 per cent forecast by Edmonton Power and the 87 per cent forecast by the Combined Utilities and Foster.

The Board generally believes that the electrical demand load factor of 62 per cent suggested by the City of Edmonton for 1999 is reasonable. It further believes that an overall load factor in excess of 75 per cent is likely to be achieved at large efficient coal-fired generating stations, the installation of which is expected to commence in the Edmonton area in the late 1980's and the 1990's. Since the Board expects that gas will supply only 34 per cent of Edmonton Power's fuel requirements in 1999, and coal the remaining 66 per cent, the Board believes a group load factor of 50 per cent to be reasonable for the gas fired units in 1999. The Board therefore adopts this load factor for the gas demand of Edmonton's electrical utility.

Because the Board believes there will be similar incentives to use gas-fired generating stations for peaking purposes in other parts of the Province, and because Edmonton Power gas requirements are expected to comprise a substantial part of the total requirements for Power Generation, the Board also adopts a load factor of 50 per cent for the total gas demand of the Province's generating stations in 1999.

There was general agreement among the interveners that the 1999 load factor for the Industrial and Contingent categories, exclusive of requirements for Power Generation, would be in the range of 80 to 85 per cent. The Board believes that, with some increasing tendency to use gas for peaking purposes in this demand category, the adoption of an 80 per cent load factor is reasonable for 1999.

On the basis of the analysis adopted in Section VI, the Permit Related requirements are expected to be only 2 billion cubic feet in 1999 and to be associated entirely with Edmonton Liquid Gas, since all the existing major gas removal permits are scheduled to expire before the end of the forecast period. The utility companies' Operating requirements are projected to be some 7 billion cubic feet. Further, since virtually all these requirements are associated with deliveries to Alberta consumers a load factor of 50 per cent, approximating the Alberta average load factor, appears reasonable and is adopted for these requirements.

The Board's estimates of load factors and peak day requirements to 1999 are summarized in Table VII-1. The use of the component load factors with the requirements discussed in previous sections results in a provincial load factor of 51 per cent in 1999, as compared to the present load factor of some 50 per cent for the Non-Permit Related requirements. Exclusion of the Permit Related requirements from the 1969 load factor provides a more meaningful comparison since, on the basis of the analysis in Section VI, these requirements will be negligible in 1999. The load factor

determined by the Board is less than the corresponding load factors of 58 per cent, 64 per cent and 56 per cent proposed by Hedlin Menzies, Foster and the Combined Utilities, respectively. The principal reasons for the differences between the estimates of the interveners and the Board's estimates are as follows:

- (a) the Board used a gas demand load factor of 50 per cent for the Thermal electric category, whereas the Combined Utilities, Hedlin Menzies and Foster used the presently experienced load factor of some 87 per cent;
- (b) the Board assumed a load factor of 80 per cent for combined Industrial and Contingent requirements, exclusive of Power Generation, whereas the Combined Utilities applied a load factor of 85 per cent to the Contingent Requirements; and
- (c) the Board's load factor reflects the virtual elimination of Permit Related gas requirements in 1999, whereas Foster's load factor is based on 1969 experience and hence, incorporates a significant proportion of consumption in this high load factor category.

The use of a provincial load factor of 51 per cent with the 1999 annual gas requirements of some 647 billion cubic feet results in a 1999 peak day demand of 3.45 billion cubic feet, as shown in Table VII-1. This compares with the corresponding peak day demands of 3.30 and 2.64 billion cubic feet, forecast by Hedlin

Menzies and Foster, respectively, and 3.60 billion cubic feet adopted by the Board for the same period in OGCB Report 70-B.<sup>(4)</sup> The 1999 peak day requirements forecast by the Combined Utilities excluded Permit Related requirements and were 3.57 billion cubic feet.

---

(4) In the Matter of an Application of Trans-Canada Pipe Lines Limited under The Gas Resources Preservation Act, 1956. 1970.

TABLE VII-1

BOARD  
FORECASTS OF LOAD FACTORS AND  
PEAK DAY GAS REQUIREMENTS  
1999

<u>REQUIREMENT CATEGORY</u>	<u>LOAD FACTOR PER CENT (1)</u>	<u>ANNUAL REQUIREMENTS BCF (2)</u>	<u>PEAK DAY REQUIREMENTS BCF/DAY (3)</u>
RESIDENTIAL AND COMMERCIAL	0.35	222	1.74
INDUSTRIAL AND CONTINGENT (EXCLUDING POWER GENERATION)	0.80	300	1.03
POWER GENERATION (BASED PRINCIPALLY ON EDMONTON POWER DATA)	0.50	116	0.63
PERMIT RELATED AND GAS UTILITY OPERATING REQUIREMENTS	<u>0.50</u>	<u>9</u>	<u>0.05</u>
	0.51	647	3.45



### VIII FINDINGS

In preceding sections the Board has reviewed the evidence and presented its own estimates of the various types of provincial gas requirements described in Informational Letter No. IL 70-2<sup>(1)</sup>. In this section the Board has summarized its estimates of gas requirements which, in accordance with the terms of the Informational Letter, relate to the period 1970 to 1999. Prior to the gas requirements hearing, the Board published in OGCB Report 70-B<sup>(2)</sup> a forecast of the Province's future gas requirements which also related to the period 1970 to 1999. In summarizing its current estimates of the Province's gas requirements, the Board has commented on the major differences between these estimates and the previous forecast.

#### 1. RESIDENTIAL GAS REQUIREMENTS

The Board estimates that the Province's Residential gas requirements will increase from 58 billion cubic feet in 1970 to some 109 billion cubic feet in 1999 and that these requirements will total 2,536 billion cubic feet over the 30-year period. In OGCB Report 70-B, the Board anticipated somewhat greater growth in Residential gas requirements, which were estimated to reach a level of some 130 billion cubic feet in 1999 and to total

---

(1) The Informational Letter is reproduced in Appendix A.

(2) In the Matter of an Application of Trans-Canada Pipe Lines Limited under The Gas Resources Preservation Act, 1956. 1970.

2,733 billion cubic feet over the 30-year period. The Board believes that the growth in Residential gas requirements will be less than the levels in its previous forecast, mainly because of developments associated with Commercial gas requirements.

2. COMMERCIAL GAS REQUIREMENTS

The Board estimates that the Province's Commercial gas requirements will increase from 51 billion cubic feet in 1970 to some 114 billion cubic feet in 1999 and that these requirements will total 2,448 billion cubic feet over the 30-year period. In OGCB Report 70-B, the Board adopted a lower estimate for the terminal year, some 109 billion cubic feet, and also a lower estimate of 30-year Commercial gas requirements, some 2,240 billion cubic feet. The Board has concluded that more substantial growth may be expected in Commercial gas requirements, based on the increasing importance of apartments and other commercial establishments in urban areas.

3. INDUSTRIAL AND CONTINGENT GAS REQUIREMENTS

These requirements embrace provisions for both existing and new industrial concerns within the Province, but exclude Permit Related gas requirements and the Operating requirements of gas utility companies. The Board estimates that Industrial and Contingent gas requirements will be 416 billion cubic feet in 1999, as compared to 128 billion cubic feet in 1970, and that the requirements will total 8,520 billion cubic feet over the

30-year period. In the corresponding estimates underlying the Board's forecast in OGCB Report 70-B, the requirements were projected to reach some 503 billion cubic feet in 1999 and to total 9,559 billion cubic feet over the 30-year period. The Board's previous estimates were developed mainly on the basis of an examination of the future requirements of individual plants. The Board's current forecast is based partly on this method of estimating the requirements and partly on evidence regarding trends in overall energy requirements. The Board's current estimates include an allowance for the use of gas in power generation which amounts to 2,617 billion cubic feet over the 30-year period, and is very similar to the Board's previous determination of these requirements. An important feature of the current forecast is that the Board has discontinued its former provision for the gas requirements of Peace River Mining & Smelting Ltd. The Board believes the reduction in Industrial and Contingent gas requirements to be warranted both for this reason and because the evidence presented to the Board suggests that the long term growth of the requirements will be restricted by the growth of electricity consumption.

#### 4. OPERATING REQUIREMENTS OF GAS UTILITY COMPANIES

In OGCB Report 70-B, the Board did not give specific recognition to the fuel requirements and losses associated with the operation of gas utility companies in the Province. In the current forecast, the Board has assessed the Operating

requirements of gas utility companies at 1.1 per cent of estimated Residential, Commercial and Industrial and Contingent gas requirements. On this basis, the Board estimates that the Operating requirements of gas utility companies will rise from some 3 billion cubic feet in 1970 to 7 billion cubic feet in 1999 and total 149 billion cubic feet over the 30-year period.

5. PERMIT RELATED GAS REQUIREMENTS

The Permit Related gas requirements are intended to reflect the fuel requirements and losses of Trunk Line, and the fuel requirements and shrinkage associated with gas reprocessing plants in the Province. In the Board's current forecast, the Permit Related gas requirements are estimated at some 65 billion cubic feet in 1970. Over the following 10-year period, the requirements are expected to increase, reaching a maximum of 114 billion cubic feet in 1981. Subsequently, the Permit Related gas requirements, which are based on permits authorized up to the end of 1970, are estimated to decline and to be reduced to negligible quantities in the final years of the forecast. The Board's current estimates of Permit Related gas requirements total 2,116 billion cubic feet over the 30-year period 1970 to 1999, as compared to the estimate of 1,773 billion cubic feet underlying the Board's previous forecast in OGCB Report 70-B. The higher estimate in the current forecast is based on more recent and detailed information regarding the future operations of Trunk Line and the various reprocessing plants in the Province, and also reflects amendments to Permit No. TC 69-9

which were not provided for in the previous forecast.

6. TOTAL ALBERTA GAS REQUIREMENTS

On an annual basis, the Board estimates that Alberta's total gas requirements will increase from 305 billion cubic feet in 1970 to 647 billion cubic feet in 1999 and that the total requirements will amount to 15,767 billion cubic feet over the 30-year period. In relation to the Board's previous forecast published in OGCB Report 70-B, the current estimates for the terminal year and for the period as a whole are lower by 94 billion cubic feet and 536 billion cubic feet, respectively. The lower estimate for Residential gas requirements in the current forecast is almost exactly offset by the higher provision for Commercial gas requirements. The Board's current estimates of Permit Related gas requirements are higher than the previous forecast and, in addition, the Board has made a separate allowance for the Operating requirements of gas utility companies. The lower estimate of total Alberta gas requirements in the current forecast arises from the reduction in the estimates of Industrial and Contingent gas requirements. The Board's current estimates of total Alberta requirements are shown on an annual basis in Table VIII-1. For comparative purposes, the Table also shows the estimates of total Alberta requirements submitted by the various interveners at the gas requirements hearing.

7. PEAK DAY REQUIREMENTS

The Board estimates that Alberta's Peak Day requirements for

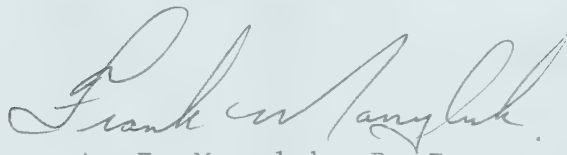


gas in 1999 will be 3.45 billion cubic feet. The Board's current estimate of Peak Day requirements compares to the estimate of 3.6 billion cubic feet published in OGCB Report 70-B. The new estimate of Peak Day requirements is based on a lower estimate of total Alberta requirements in the terminal year of the forecast. In determining the Peak Day requirements, the Board has examined the load factors for various types of gas requirements and has concluded that the load factors for most types of requirements will remain unchanged from existing levels. However, the Board believes that there will be some reduction in the load factor relating to gas for power generation.

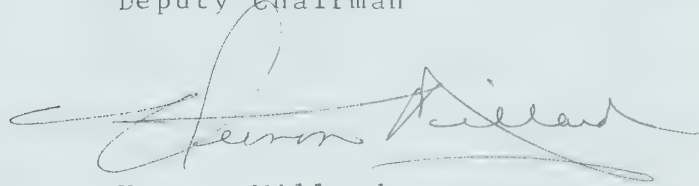
OIL AND GAS CONSERVATION BOARD



G. W. Govier, P. Eng.  
Chairman



A. F. Manyluk, P. Eng.  
Deputy Chairman



Vernon Millard  
Board Member

Dated at Calgary, Alberta

this 26th day of February, A. D. 1971.

TABLE VIII-1

FORECASTS OF  
TOTAL ALBERTA GAS REQUIREMENTS  
(BILLIONS OF CUBIC FEET)

YEAR	BOARD STAFF (1)	COMBINED UTILITIES* (2)	CONSOLIDATED (3)	ALBERTA & SOUTHERN AND TRANSCANADA (4)	BOARD (5)
1970	309.5	244.0	306.7	308.2	305.1
1971	335.7	248.7	332.1	329.6	331.1
1972	363.6	268.2	373.0	352.1	362.0
1973	386.4	286.9	385.4	370.1	388.4
1974	403.7	301.9	395.9	386.0	405.5
1975	435.9	320.4	407.7	412.6	435.7
1976	459.1	342.1	419.5	425.6	454.0
1977	478.2	356.3	432.4	444.4	470.4
1978	494.0	381.7	445.2	459.8	482.4
1979	507.9	396.7	458.8	473.0	495.1
1980	534.0	414.9	472.6	483.8	509.2
1981	547.6	424.2	486.8	492.1	522.8
1982	559.7	441.2	500.9	511.9	536.5
1983	568.7	450.5	509.7	514.5	545.0
1984	576.8	511.3	516.1	518.4	551.6
1985	588.2	520.8	526.2	528.5	563.4
1986	590.2	530.5	535.6	528.4	567.2
1987	590.3	540.4	545.5	527.4	575.4
1988	575.8	550.2	555.4	512.3	579.5
1989	584.4	560.1	564.5	525.0	582.9
1990	590.1	570.3	554.3	529.6	582.8
1991	605.4	581.5	554.5	540.1	589.8
1992	616.5	592.8	570.7	545.0	598.5
1993	625.7	604.3	586.6	555.2	605.1
1994	624.5	615.9	597.1	559.8	605.9
1995	617.8	685.1	612.5	571.4	605.0
1996	625.1	696.9	634.6	580.5	611.5
1997	637.6	708.7	657.8	600.3	623.2
1998	649.9	720.7	681.8	605.1	635.2
1999	662.8	732.8	706.4	620.2	647.2
30-YEAR REQUIREMENTS 1970 TO 1999	16,145	14,600	15,326	14,811	15,767
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.7	3.9	2.9	2.4	2.6
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE 30-YEAR TOTAL (%)	3.6	4.4	3.3	3.1	3.5

\* THE COMBINED UTILITIES' FORECAST MADE NO PROVISION FOR PERMIT RELATED GAS REQUIREMENTS.

APPENDIX A

THE PROVINCE OF ALBERTA  
OIL AND GAS CONSERVATION BOARD

Informational Letter  
No. IL 70-2

To: All Operators, Major Gas Purchasers,  
Gas Transmission Companies and  
Principal Cities

Gas Requirements Hearing

Following a hearing before the Board in June 1969 to review its policies and procedures for considering applications under The Gas Resources Preservation Act, 1956, the Board announced its intention of holding hearings once every three years to determine the Province's long term requirements for natural gas. The Board's decisions on this and related matters are contained in OGCB Report 69-D.

At the time the report was published, it was anticipated that it would be appropriate to hold the first of the three-yearly hearings regarding the Province's long term gas requirements in mid-April, 1970. The Board now believes it desirable to defer the hearing until June 16, 1970 in order to give all interested parties ample time to prepare comprehensive estimates. The Board staff is currently engaged in completing a detailed regional population forecast which will be incorporated in its own estimates and submission.

The Board is particularly anxious that the evidence submitted

by the various parties at the hearing should be on a comparable basis. In this connection, the Board believes it will be helpful if the following guidelines are observed in the preparation of evidence.

1. Scope of Hearing. The matters to be considered at the hearing are the Province's 30-year requirements and 30th year peak day requirements.

2. Definition of 30-year Period. The 30-year requirements relate to the period commencing January 1, 1970 and ending December 31, 1999.

3. Heating Value. Estimates of future requirements should be converted to the basis of 1,000 Btu's at 14.65 psia and 60°F.

4. Categories of Consumption. Estimates of future requirements should be classified according to the following categories: Domestic, Commercial, Industrial, 'Other' Industrial and Contingency requirements. A brief definition of the various categories is given below:

(a) Domestic. Requirements relating to residential uses, including house heating.

(b) Commercial. Requirements relating to hotels, restaurants, stores, professional and business offices and apartment blocks.

(c) Industrial. Requirements relating to industrial and manufacturing plants, other than plants in category (d). Requirements relating to relatively firm plans to expand existing facilities, or construct new facilities, should be included in the industrial category.

- (d) 'Other' Industrial. Requirements relating to fuel use by Alberta Gas Trunk Line and fuel use and shrinkage at gas reprocessing plants which are either in operation or the construction of which has been approved by the Board. The requirements in this category should be based on existing gas removal permits
- (e) Contingency. Requirements relating to new industrial and manufacturing plants for which there is a reasonable expectation in the future but for which no firm commitment has been made in the present.

A Notice of Hearing will be issued in the near future and will request that submissions in connection with the hearing should be received no later than Friday, May 22, 1970.

ISSUED at the City of Calgary, in the Province of Alberta, this 20th day of January, A. D. 1970.

OIL AND GAS CONSERVATION BOARD

V. Millard  
Board Member





## APPENDIX B

### POSITION STATEMENT OF CITY OF CALGARY BEFORE OIL AND GAS CONSERVATION BOARD REQUIREMENTS HEARINGS

At the outset, The City of Calgary wishes to emphasize as it has in the past, its support of the present policies of the Province of Alberta relative to the export of natural gas.

Members of the City of Calgary Gas and Power Sub-committee have reviewed the various submissions prepared for the Board's consideration relative to the 30-year natural gas requirements of the Province. It is the opinion of the Committee and their experts that all of the requirements forecast are in close agreement, therefore, keeping in mind that these requirement hearings will in future be held on a regular and recurring basis every three years, we would accept any findings which the Board might reach within the various forecasts.

With regard to the City of Edmonton Brief on Future Gas Requirements for Power Production, the City of Calgary believes that the electrical forecasts contained therein to 1990 are reasonable based on the past history of the electrical industry in this province and projections of various major utilities and commissions throughout North America relative to future growth within the industry. Beyond 1990 the difficulty in forecasting becomes apparent; however, we would note that any major conversion from other fuel sources (i.e. petroleum) to electricity within the next 30 years, and in specifics, considering the electric car,

the electrical forecasts contained in the Edmonton brief would be more than realized. The question then before the Board becomes whether natural gas will be the fuel source for these electrical energy requirements and/or whether other fossil or nuclear fuels or hydro will provide the requirements. As the Board is aware, the City of Calgary also operates a major electrical distribution utility and is equally concerned as to the source of its future electrical energy requirements which from past experience we anticipate will be no less than Edmonton's.

We would therefore recommend to the Board that they request the Provincial Government to undertake a total energy requirement study for the province, covering the next 30 years and investigate the various sources of energy and fuels available within the province to meet these requirements and to apportion requirements between the various energy and fuel sources. Such a study could be undertaken either through a system of hearings on a commission basis similar to the operation of the Oil and Gas Conservation Board or be directed and financed by the Province utilizing the resources contained in part within the various energy supply companies now operating within the province. A study of this kind would determine prior to the next Requirements Hearing, not only whether the natural gas requirements established through this Board are adequate for the future when all of the energy requirements of the Province are considered, but also would determine whether the future electrical requirements of this province would be supplied in any great portion through the use of natural gas

fuels. The City of Calgary would be most pleased to participate in any such inquiry.

June 30, 1970





## APPENDIX C

### REVIEW AND COMPARISON OF THE ENERGY FORECASTS SUBMITTED BY CONSOLIDATED AND ALBERTA & SOUTHERN AND TRANSCANADA

---

The purpose of this appendix is to present in detail the estimates of the Province's future energy requirements submitted by Consolidated and Alberta & Southern and TransCanada. The submissions were prepared by Hedlin Menzies & Associates Ltd. (Hedlin Menzies) and Foster Economic Consultants Ltd. (Foster), respectively. The two forecasts employed different definitions of total energy as well as different methods of determining the requirements. In the course of reviewing the forecasts, the Board has drawn attention to the different bases on which the estimates were prepared. The two principal differences concern the treatment of electricity consumption and permit related gas requirements.<sup>(1)</sup> Hedlin Menzies included electricity consumption in its definition of total energy in both the industrial and the residential and commercial sectors. By contrast, Foster did not include electricity consumption in its estimates of energy requirements in the industrial and the residential and commercial sectors. In the industrial sector, however, Foster's estimates of fossil fuel requirements included amounts required to generate electricity in both the industrial and the residential and commercial sectors. Permit related gas requirements, which formed part of Foster's estimates of energy requirements in the industrial sector, were

---

(1) Permit related gas requirements refer to fuel used by Trunk Line and fuel use and shrinkage at gas reprocessing plants. These requirements are discussed in Section VI of the report.

excluded from Hedlin Menzies' forecast of energy requirements. Because of these and other differences in the definitions of energy requirements, the two forecasts are not comparable in the form in which they were originally submitted. Therefore, in the final part of this appendix, the Board has made a number of adjustments in order to place the two forecasts on a comparable basis.

### Review of Energy Forecasts

#### Views of Consolidated

The submission prepared by Hedlin Menzies examined the energy requirements of two sectors: the industrial sector and the combined residential and commercial sector. Hedlin Menzies did not assess the energy requirements of the transportation sector.

The various forms of energy considered by Hedlin Menzies were the power generated by electric utility companies and industrial plants, and requirements for natural gas, petroleum and coal by users other than electric utilities. The fuels required to generate the projected levels of electricity consumption were considered separately from the forecasts of energy requirements. Historical data for the various types of energy were converted to British thermal units (Btu's), using the heating values shown in column (1) of Table C-11. On the basis of a linear relationship estimated from the historical data, Hedlin Menzies found that the total energy requirements in the residential and commercial sector were highly correlated with the stock of

households in the Province. In the industrial sector, a high correlation was exhibited by a linear equation relating total energy to a provincial series for real value-added in mining, manufacturing and forestry. The two linear relations were used, in conjunction with forecasts for households and real value-added, to project total energy requirements in the respective sectors during the period 1970 to 1999. Within each sector, the requirements for specific types of energy were projected on the basis of percentage shares in total energy requirements. The features of Hedlin Menzies energy forecast are considered in more detail below.

(1) Residential and Commercial Sector

Hedlin Menzies treated the residential and commercial sectors as one sector. The total energy requirements of the combined residential and commercial sector were projected by using a linear equation relating total energy to the number of households. The linear equation was estimated on the basis of historical data for the period 1950 to 1969. The historical data for natural gas, petroleum fuels, electricity and coal were obtained from the Dominion Bureau of Statistics (DBS) and also from the Board.<sup>(2)</sup> The regression equation employed by Hedlin Menzies took the following form:

$$T.E._{R/C} = -43.530 + 0.420 \text{ H.H.}$$

where  $T.E._{R/C}$  is the total energy consumption in the combined residential and commercial sector

and  $H.H.$  is the number of households.

---

(2) Hedlin Menzies stated that the 1969 natural gas requirements were not comparable to the other historical estimates due to the fact that the 1969 figures were adjusted to a normal degree day basis.

The coefficient of determination was calculated to be 0.98. The t-statistic calculated for the household coefficient was found to be significant at the 99 per cent confidence level.

Testimony by Hedlin Menzies at the hearing indicated that variables other than the number of households were considered prior to adopting the above equation. However, on the basis of the results obtained from regression analyses, Hedlin Menzies believed that the number of households provided a better explanation of historical changes in energy requirements than other indicators, such as population and per capita income. Hedlin Menzies professed a great deal of confidence in the equation employed in the forecast mainly because of the high value obtained for the coefficient of determination. When questioned as to the meaning of the negative intercept in the equation, the witness for Hedlin Menzies stated that the equation was not intended to apply to small numbers of households.

Over the forecast period, Hedlin Menzies projected the number of households to grow from 442 thousand in 1970 to 758 thousand in 1999. Employing this projection in the linear equation, Hedlin Menzies estimated that the total energy requirements of the combined residential and commercial sector would grow from 142 trillion Btu's in 1970 to 275 trillion Btu's in 1999. The 30-year requirements total 6,368 trillion Btu's. Hedlin Menzies' forecast of energy requirements for the combined residential and commercial sector, by energy type, is shown in Table C-1.

Hedlin Menzies submitted that natural gas would remain the

major source of energy in the residential and commercial sector. Over the forecast period, Hedlin Menzies estimated that the residential and commercial requirements for natural gas would increase from 108 trillion Btu's in 1970 to 209 trillion Btu's in 1999, equivalent to an average annual growth rate of 2.3 per cent. On this basis, the 30-year requirements total 4,840 trillion Btu's. Natural gas was projected to maintain a share of total energy requirements of approximately 76 per cent.

Hedlin Menzies expressed the opinion that the share of total energy requirements in the residential and commercial sector accruing to electricity would increase from 9 per cent in 1970 to 20 per cent in 1999. The share of energy requirements associated with electricity reflected a 5 per cent average annual growth rate for electricity consumption which Hedlin Menzies believed to be reasonable for the residential and commercial sector. On this basis, the electricity consumption of the residential and commercial sector, as shown in column (2) of Table C-1, was estimated to increase from 13 trillion Btu's in 1970 to 54 trillion Btu's in 1999. The 30-year requirements total 877 trillion Btu's.

For the purpose of assembling historical data Hedlin Menzies defined petroleum as consisting of diesel fuel oil, both light and heavy fuel oil, kerosene, stove oil and propane. Hedlin Menzies assumed that all propane requirements, as reported by the Board, were related to uses in the residential and commercial sector. Although Hedlin Menzies presented historical data for both petroleum and coal requirements, it did not show



projections for these two fuels over the forecast period. The Board has calculated the projected requirements for petroleum and coal by subtracting the estimates of gas and electricity consumption from the forecast of total energy requirements.

Hedlin Menzies forecast that the share of total energy requirements supplied by petroleum and coal in the combined residential and commercial sector would decline from 15 per cent in 1970 to 4 per cent in 1999. As shown in column (3) of Table C-1, petroleum and coal requirements decrease from 21 trillion Btu's in 1970 to 12 trillion Btu's in 1999, and total 652 trillion Btu's over the forecast period. At the hearing, Hedlin Menzies expressed the opinion that the use of coal would progressively lessen as the final years of the forecast period were approached.

## (2) Industrial Sector

Hedlin Menzies projected the total energy requirements of the industrial sector by using a linear equation relating total energy to a provincial series for real value-added in mining, manufacturing and forestry. The linear equation was estimated on the basis of historical data for the period 1950 to 1969. The historical data for natural gas, petroleum fuels, electricity and coal were obtained from DBS and also from the Board. The historical data for these fuels excluded amounts required for power generation. In the case of natural gas, the historical data also excluded requirements associated with permits to remove gas from the Province. The regression equation employed by Hedlin Menzies took the following form:

$$T.E._I = -13.824 + 0.1333 V.A.$$

where  $\frac{T.E.}{I}$  is the total energy consumption in the industrial sector

and  $V.A.$  is the real value-added.

The coefficient of determination was found to be 0.97. The t-statistic for the value-added coefficient was calculated to be significant at the 99 per cent confidence level.

The witnesses for Hedlin Menzies testified that variables other than real value-added in mining, manufacturing and forestry were considered prior to adopting the above equation, but were found to be less satisfactory. The historical data for the provincial series of real value-added were determined from the total value of output in the selected industries by subtracting the costs of all materials, supplies, fuel and electricity consumed in the production process. The historical series was expressed in terms of 1949 dollars using the price deflator of Gross National Product. When questioned as to the accuracy of the adjusted series, Mr. Lee of Hedlin Menzies replied that the price deflator of Gross National Product appeared to be the best one to apply in the absence of a provincial price deflator.

Hedlin Menzies estimated that the real value-added in mining, manufacturing and forestry would increase at an average annual rate of 5 per cent. Using this projection, in conjunction with the linear equation, Hedlin Menzies estimated that the total energy requirements of the industrial sector would increase from 120 trillion Btu's in 1970 to 536 trillion Btu's in 1999, as shown in column (4) of Table C-2. The 30-year requirements total

8,463 trillion Btu's.

Hedlin Menzies believed that natural gas would continue to be the predominant source of industrial energy over the forecast period. However, it was assumed that the proportion of total industrial energy supplied by natural gas would decline from the 1970 level of 79 per cent to 75 per cent in 1999. This decline reflected in part Hedlin Menzies' opinion that natural gas would become more expensive relative to electric energy over the forecast period. As a result, Hedlin Menzies estimated the natural gas requirements in the industrial sector to increase from 94 trillion Btu's in 1970 to 402 trillion Btu's in 1999, and to total 6,460 trillion Btu's over the forecast period.

Electricity consumption was projected to grow at an average annual rate of 7 per cent over the forecast period. On this basis, electricity consumption was estimated to rise from the 1970 level of 15 trillion Btu's to 104 trillion Btu's in 1999, and to account for some 20 per cent of energy requirements in 1999, as compared to 12 per cent in 1970. As shown in column (2) of Table C-2, estimated electricity consumption for the 30-year forecast period totals 1,386 trillion Btu's. The forecast of electricity consumption includes both the power load of electric utility companies, as well as electric power generated by industrial plants.

As in the residential and commercial sector, Hedlin Menzies assumed that petroleum and coal's share of energy requirements would decline over the forecast period from some 9 per cent in

1970 to 6 per cent in 1999. Hedlin Menzies presented historical data for both petroleum and coal, but did not show estimates of future requirements for these two fuels over the forecast period. The petroleum and coal requirements shown in column (3) of Table C-2, were calculated by the Board to increase from 11 trillion Btu's in 1970 to 30 trillion Btu's in 1999, and total 617 trillion Btu's over the forecast period. Hedlin Menzies believed that the majority of the petroleum requirements would be in the form of self-generated petroleum fuel, as in the case of crude oil refineries, and that coal, which supplied only 0.1 per cent of industrial energy in 1969, would continue to have virtually no share of the energy requirements over the forecast period.

(3) Industrial and Residential and Commercial  
Sectors

Hedlin Menzies' forecasts of total energy requirements in the combined industrial and residential and commercial sectors are presented in Table C-3. These requirements exclude both the fossil fuels for power generation and permit related natural gas requirements. As shown in column (4) of Table C-3, the total energy requirements for all sectors were estimated to increase from 262 trillion Btu's in 1970 to 811 trillion Btu's in 1999, and amount to 14,832 trillion Btu's over the forecast period. Natural gas was projected to supply the majority of the 30-year requirements, some 76 per cent, with electricity and petroleum and coal accounting for some 15 and 9 per cent, respectively.

Hedlin Menzies estimated the natural gas requirements of the combined industrial and residential and commercial sectors

to increase from 202 trillion Btu's in 1970 to 611 trillion Btu's in 1999, the equivalent of an average annual growth rate of 3.9 per cent. Despite this growth, natural gas expressed as a percentage of total energy requirements was projected to decrease from some 77 per cent in 1970 to 75 per cent in 1999. As shown in column (1) of Table C-3, 30-year natural gas requirements total 11,300 trillion Btu's.

Electricity consumption was estimated to increase at an average annual rate of 6.2 per cent from the 1970 level of 28 trillion Btu's to 159 trillion Btu's in 1999. As a result, electricity's share of the total energy requirements was calculated to grow from some 11 per cent in 1970 to approximately 20 per cent in the final year of the forecast. The 30-year requirements for electricity, as shown in column (2) of Table C-3, total 2,262 trillion Btu's.

The petroleum and coal requirements of the combined industrial and residential and commercial sectors show growth of less than 1 per cent annually over the forecast period. The Board has calculated these requirements by subtracting both the projected natural gas and electricity estimates from the total energy requirements. In absolute terms, requirements for petroleum and coal were calculated to grow from 32 trillion Btu's in 1970 to 47 trillion Btu's in 1989, and then decline to 42 trillion Btu's in 1999. The share of total energy requirements supplied by petroleum and coal was calculated to decrease from some 12 per cent in 1970 to approximately 5 per cent in the final year



of the forecast. Hedlin Menzies was of the opinion that petroleum would supply the majority of the energy requirements for these two fuels. As shown in column (3) of Table C-3, the 30-year requirements for petroleum and coal total 1,270 trillion Btu's.

#### (4) Power Generation

Hedlin Menzies assumed that all additional generating capacity would be based on fossil fuels. No allowance was made for installations of nuclear units during the forecast period, nor was allowance made for new hydro stations over the 1970 to 1999 period.

Table C-4 shows the fossil fuels required to generate the increases in the power load after 1969. Column (2) of Table C-4 shows, for each year of the forecast, the amounts by which electricity consumption was projected to increase over the 1969 level of 26.3 trillion Btu's. The anticipated increases in electricity consumption were translated into additional fossil fuel requirements as shown in column (3) of the Table. Hedlin Menzies calculated the additional fossil fuel requirements by applying a constant heat rate of 10,000 Btu's per kilowatt hour (KWH) to the projected increase in the power load.<sup>(3)</sup> On this basis, it was estimated that an additional 4,317 trillion Btu's of fossil fuels would be needed to generate the projected increase in electricity consumption.

---

(3) As used in this Appendix, heat rates are defined as the average fuel requirements to generate 1 KWH of electricity. As shown in Table C-12, 1 KWH was estimated to equal 3,412 Btu's.

As shown in column (4) of Table C-4, Hedlin Menzies estimated that additional requirements for natural gas would total 614 trillion Btu's over the forecast period. It was Hedlin Menzies' belief that natural gas would play a less significant role as a fuel for power generation. This reflected Hedlin Menzies' position that coal would continue to enjoy a price advantage over natural gas. However, it was assumed that all additions to Edmonton Power's generating capacity would be in the form of natural gas units in the period 1970 to 1980. Hedlin Menzies expressed the opinion that, after 1980, 10 per cent of the additional fuel requirements of all electric utilities in the Province would be supplied by natural gas. At the hearing, the witnesses for Hedlin Menzies stated that they would not be surprised if the use of natural gas for power generation actually declined after 1980.

Estimates of petroleum and coal requirements for power generation were not provided by Hedlin Menzies. The Board has calculated the incremental petroleum and coal requirements by subtracting the projected additional natural gas requirements from the estimates of total incremental fossil fuel requirements. On this basis, the additional petroleum and coal requirements were found to increase from 4 trillion Btu's in 1970 to 341 trillion Btu's in 1999 and to total 3,703 trillion Btu's over the 1970 to 1999 forecast period. Mr. Lee of Hedlin Menzies, testified that coal would provide the most economic alternative over the forecast period and thus would supply most of the

additional generating requirements.

Views of Alberta & Southern and TransCanada

The total energy projections prepared by Foster, on behalf of Alberta & Southern and TransCanada, were compiled by summing separate forecasts of the requirements for various fuels in the industrial and residential and commercial sectors. The energy requirements of the transportation sector were not assessed. Foster prepared its forecast as a check on the reasonableness of the natural gas forecasts which are described in the main body of this report. (4)

Foster's forecasts of total energy requirements for the industrial and residential and commercial sectors were prepared on a different basis than the forecasts presented by Hedlin Menzies. Foster did not include electricity consumption in its estimates of energy requirements in the industrial and residential and commercial sectors. However, Foster's forecasts of energy requirements for the industrial sector included estimates of the fossil fuels required to generate electricity in both the industrial and the residential and commercial sectors. In addition, Foster's estimates of total energy requirements for the industrial sector included permit related natural gas requirements and also the operating requirements of gas utility companies. Hydro requirements for power generation were not shown for individual sectors, but were included in Foster's

---

(4) Foster's estimates of natural gas requirements are discussed in detail in Sections III, IV, V, VI and VII of this report.

estimates of total energy requirements for all sectors.<sup>(5)</sup>

The various forms of energy considered by Foster were natural gas, coal, fuel oil, liquid petroleum gases, refinery gas and hydro requirements. Foster's forecasts dealt mainly with natural gas requirements. The witness for Foster stated that the estimates for fuels other than natural gas were based primarily on judgment. Foster relied for the most part on the heating values shown in column (2) of Table C-11 to convert the various fuels from normal units of measurement to billions of cubic feet of natural gas equivalent at 1,000 Btu's per cubic foot. For purposes of convenience, the Board has chosen to state the requirements in terms of trillions of Btu's.

Foster contended that its total energy forecast obtained by summing projected requirements for individual fuels compared closely with a recent forecast prepared by the National Energy Board (NEB). From this comparison, Foster concluded that its own forecasts for natural gas were realistic.

Foster also compared its total energy requirements obtained by summing the forecasts for individual fuels with projections based upon regression analyses. Regressions were performed on equations relating total energy consumption to (1) population, (2) value-added by manufacture, and (3) combined population and value-added. However, Foster rejected the use of regression analyses because, in its opinion, the historical relationships were unlikely to

---

(5) Hydro requirements were expressed in terms of the Btu inputs necessary to generate 1 KWH of electricity. Foster used a heat rate of 10,000 Btu's/KWH for hydro requirements.

apply over the forecast period. The features of Foster's energy forecasts are considered in more detail below.

(1) Residential and Commercial Sector

Foster estimated the total energy requirements of the residential and commercial sector by summing separate forecasts of natural gas, coal, fuel oil and liquid petroleum gases. Unlike Hedlin Menzies' forecast, Foster's estimates of energy requirements excluded electricity consumption. The majority of the evidence presented by Foster dealt with natural gas, with only brief comments on the projections for other forms of energy.

As shown in column (4) of Table C-5, the total energy requirements of the residential and commercial sector were expected to grow from 137 trillion Btu's in 1970 to 257 trillion Btu's in 1999. This is equivalent to an average annual growth rate of 2.2 per cent and results in 30-year total energy requirements of 5,788 trillion Btu's. Over the 30-year forecast period, Foster estimated that natural gas would supply 4,983 trillion Btu's, or 86 per cent of the total energy requirements. Petroleum fuels were projected to supply 739 billion Btu's, or some 13 per cent of total energy requirements. Only 1 per cent of the total energy requirements was expected to be supplied by coal. The 30-year requirements were estimated to total 67 trillion Btu's.

Foster projected the natural gas requirements of the combined residential and commercial sector by summing separate forecasts of residential and commercial natural gas demands. The basis of



Foster's natural gas forecast is set forth in Section III of this report. On an annual basis, natural gas requirements were estimated to grow from 109 trillion Btu's in 1970 to 231 trillion Btu's in 1999, equivalent to an average annual growth rate of 2.6 per cent. By the year 1999, Foster expected natural gas to supply about 90 per cent of the total residential and commercial energy requirements, as compared to approximately 80 per cent in 1970.

Foster defined petroleum as consisting of the requirements for fuel oil and liquid petroleum gases. As shown in column (3) of Table C-5, the requirements for petroleum were expected to remain relatively constant over the forecast period, increasing from a level of 21 trillion Btu's in 1970 to 26 trillion Btu's in 1999, totalling 739 trillion Btu's over the forecast period.

The use of coal, which amounted to some 7 trillion Btu's in 1969, was expected to diminish over the forecast period and cease entirely by 1988.

## (2) Industrial Sector

Table C-6 shows Foster's estimates of 1969 industrial energy requirements, by type of fuel, and projections for the period 1970 to 1999. Foster estimated the total energy requirements by summing separate projections of natural gas, coal and petroleum. Petroleum was defined to include fuel oil, liquid petroleum gases and refinery gas. The natural gas estimates shown in column (1) of Table C-6 include permit related gas requirements associated with the removal of natural gas from the Province and also the operating requirements of gas utility companies. The projected total energy requirements also include estimates of the volumes

of fossil fuels required for power generation in both the industrial and the residential and commercial sectors.

As shown in column (4) of Table C-6, the total energy requirements of the industrial sector were estimated to grow from 275 trillion Btu's in 1970 to 1,314 trillion Btu's in 1999, and to total 20,649 trillion Btu's over the forecast period. Natural gas and coal were expected to supply 19,842 trillion Btu's or some 96 per cent of the 30-year energy requirements and to be of equal importance in this respect.

Foster projected that natural gas, expressed as a percentage of the annual requirements for total energy, would decline rapidly over the forecast period from some 73 per cent in 1970 to some 30 per cent in 1999. In absolute terms, natural gas requirements were estimated to grow from 199 trillion Btu's in 1970 to 389 trillion Btu's in 1999. Over the forecast period, the share of total energy accruing to coal was projected to increase from 20 per cent in 1970 to some 68 per cent in 1999. Foster projected coal requirements at 888 trillion Btu's in 1999, as compared to some 54 trillion Btu's in 1970. Petroleum was expected to supply only 807 trillion Btu's over the 30-year forecast period, increasing from 21 trillion Btu's in 1970 to 37 trillion Btu's in 1999.

All the industrial coal requirements shown in column (2) of Table C-6 are associated with requirements for power generation. The industrial natural gas requirements also reflect volumes required for power generation, although these volumes are less substantial than in the case of coal. The industrial requirements

for petroleum include small amounts for use in power generation.

Table C-8 shows the portions of industrial requirements for various fuels which were associated with power generation in Foster's forecast. With the exception of a new hydro-electric station at the Big Horn Dam in 1972, natural gas and coal were expected to supply all the incremental fuel requirements for power generation during the forecast. The hydro requirements, which were estimated to be 13.8 trillion Btu's in 1970, were anticipated to increase by 2.4 trillion Btu's in 1972, and to stay constant at 16.2 trillion Btu's over the remainder of the forecast period. Total fuel requirements were projected to increase from 107 trillion Btu's in 1970 to 995 trillion Btu's in 1999, and to total 12,814 trillion Btu's over the forecast period.

As shown in column (1) of Table C-8, natural gas requirements for power generation were estimated to grow from 36 trillion Btu's in 1970 to 101 trillion Btu's in 1989, and thereafter to decline in an irregular pattern to 88 trillion Btu's by 1999. The 30-year gas requirements total 2,258 trillion Btu's. Over the forecast period, the proportion of the total fuel requirements for power generation supplied by gas was projected to decline from some 34 per cent in 1970 to 9 per cent in 1999. This decline reflected Foster's opinion that coal would be the preferred fuel for the majority of electric utility companies in the Province. Sustained growth in gas requirements was forecast for only two utilities, the City of Medicine Hat and Edmonton Power. The growth in the City of Medicine Hat's gas requirements was expected

to continue at modest rates throughout the forecast period.

Natural gas was expected to supply all Edmonton Power's requirements in the period 1970 to 1980. In the period 1981 to 1989, Foster assumed that Edmonton Power's incremental fuel requirements would be supplied equally by natural gas and coal. After 1989, it was assumed that all Edmonton Power's incremental fuel requirements would be supplied by coal.

As already mentioned, Foster's estimates of industrial coal requirements relate solely to the use of this fuel for power generation. The increase in coal requirements, which rise from 54 trillion Btu's in 1970 to 888 trillion Btu's in 1999 is equivalent to an average annual growth rate of more than 10 per cent. In the period 1970 to 1980, the increase in coal requirements, shown in column (2) of Table C-8, is associated with electric utility companies other than Edmonton Power. After 1980, the growth in coal requirements for power generation is attributable in part to Edmonton Power's requirements. As shown in column (2) of the Table, the Province's coal requirements for power generation were expected to rise from a level of 164 trillion Btu's in 1980 to a level of 384 trillion Btu's in 1989. Foster predicted that Edmonton Power's expansion program during this period would be based partly on coal and partly on natural gas. Over the last 10 years of the forecast period, when Edmonton Power was expected to base its expansion program entirely on coal, the provincial coal requirements exhibit even more substantial growth. When questioned as to the availability of coal for power generation, Mr. Simon, witness for Foster, stated that he believed that 1.5

billion tons of suitable reserves would be economically recoverable during the next 30 years. Mr. Simon felt these reserves to be adequate in relation to 30-year requirements of approximately 600 million tons in Foster's forecast. It was Foster's contention that the increase in coal requirements was realistic since coal was believed to be more economic than other fuels for power generation.

(3) Industrial and Residential and  
Commercial Sectors

The total energy requirements estimated by Foster for the combined industrial and residential and commercial sectors are shown in Table C-7. These requirements include the fossil fuels used for power generation, permit related gas requirements, and also the operating requirements of gas utility companies. The total energy requirements include as well, hydro requirements which were not allocated by Foster to the individual sectors.

As shown in Table C-7, the total energy requirements for all sectors were estimated to increase from 425 trillion Btu's in 1970 to 1,587 trillion Btu's in 1999, amounting to 26,916 trillion Btu's over the 30-year forecast period. This is equivalent to an average annual growth rate of 4.6 per cent. Foster stated that the total energy projection compared closely with a recent NEB forecast, for those years where a comparison was possible. The NEB forecast for Alberta results in a 5.4 per cent annual growth rate over the 1966 to 1990 period, as compared to 5.1 per cent over the corresponding period in Foster's forecast.



Natural gas and coal were expected to be the major sources of energy over the forecast period, supplying some 93 per cent of the total 30-year energy requirements. Natural gas was expected to increase from 308 trillion Btu's in 1970 to 620 trillion Btu's in 1999. However, Foster asserted that natural gas would become less important relative to coal as a source of energy over the forecast period. Foster estimated that the natural gas requirements would decrease from some 73 per cent of total energy requirements in 1970 to some 39 per cent in 1999. As shown in Table C-7, Foster estimated coal requirements to grow from 61 trillion Btu's in 1970 to 888 trillion Btu's in 1999. As a result, the portion of total energy supplied by coal was calculated to increase from 14 per cent in 1970 to 56 per cent in 1999. All the increase in coal requirements was expected to occur in the industrial sector and, within the industrial sector, these requirements are wholly attributable to the use of coal for power generation. Although Foster's total energy projections were close to those of the NEB for the period up to 1990, Foster acknowledged that the two forecasts embodied different estimates of fuel requirements for power generation. Foster believed that the close agreement between the forecasts of total energy requirements was more significant than the fact that there were differences in the estimates of fuel requirements for power generation.

#### Comparison of Energy Forecasts

The Board has reviewed the energy forecasts prepared by

Hedlin Menzies and Foster. The Board notes that the two forecasts employed different definitions of total energy. The principal difference concerns the treatment of electricity consumption. Hedlin Menzies included electricity as part of its total energy requirements. By contrast, Foster did not include electricity consumption in its estimates of energy requirements but, within the industrial sector, Foster estimated the fuels required to generate the anticipated electricity demand in both the industrial and the residential and commercial sectors.

As discussed in Section II of this report, the Board believes that some consideration of energy requirements is useful in preparing a forecast of gas requirements. The Board has found this approach to be particularly helpful in appraising the Industrial and Contingent gas requirements outlined in Section IV of the report. For this reason, the Board believes a comparison of the forecasts to be desirable. As a basis of comparison, the Board has adopted Hedlin Menzies' definition of total energy requirements.

The Board sees advantages in Hedlin Menzies' procedure of treating the demand for electricity as part of the total energy requirements. The Board believes that the relatively high growth rates for electricity consumption, which were supported by the greater part of the evidence on the subject at the hearing, warrant an explicit consideration of the impact of electricity consumption. The Board is also of the opinion that the fossil fuels required for power generation can be more conveniently considered outside the forecast of total energy requirements. The

Board notes that the volumes of fossil fuels required for power generation are affected not only by levels of electricity consumption, but also by combustion efficiencies. The Board believes that it is easier to give recognition to each of these factors if fuel requirements for power generation are considered outside the framework of the total energy forecast. Similarly to Hedlin Menzies, the Board believes that permit related gas requirements should be excluded from the energy requirements. The majority of the permit related gas requirements are attributable to the extraction of natural gas liquids at reprocessing plants within the Province. To the extent that the natural gas liquids are marketed within Alberta, they are already reflected in the requirements for petroleum fuel. To the extent that the natural gas liquids are marketed outside the Province, the Board believes that they should not form part of Alberta's energy requirements. The Board has also excluded from the Provincial total energy requirements, the operating requirements of gas utility companies, primarily because Foster did not present separate estimates of the latter requirements on an annual basis.

"Since Hedlin Menzies' definition of total energy appears preferable, the Board, for purposes of comparison has made a number of adjustments to Foster's forecast of energy requirements. The Board has been unable to make a comparison between the two forecasts on a sector by sector basis. This arises from the fact that, although Foster presented evidence on levels of total electricity consumption, it did not state what the growth of

electricity consumption would be in the various sectors. Therefore, the Board's comparison of the two forecasts has been restricted to an examination of the estimates of the energy requirements for all the sectors combined. In addition, the Board has made a comparison of Hedlin Menzies' and Foster's forecast of fuel requirements for power generation outside the framework of the total energy forecast.

(1) Industrial and Residential and  
Commercial Sectors

Table C-9 shows a comparison of Hedlin Menzies' and Foster's forecasts of total energy requirements for the combined industrial and residential and commercial sectors. For purposes of comparison, the Board has adjusted Foster's estimates of energy requirements to exclude fuels used for power generation. Also, the Board has adjusted Foster's estimates of gas requirements to exclude the volumes of permit related gas requirements and the operating requirements of gas utility companies. Finally, the Board has included in Foster's forecast of total energy requirements estimates of electricity consumption, based on the growth rates contained in Alberta & Southern and TransCanada's submission. Foster predicted that the growth rate of total electricity consumption would decline by 0.1 per cent annually from 9.5 per cent in 1970 to 6.6 per cent in 1999.

After these adjustments, Foster's forecast of the total energy requirements for all sectors is in reasonably close agreement with Hedlin Menzies' estimates. For the period 1970 to 1999, Foster's total energy requirements amount to 15,619

trillion Btu's, as compared to 14,832 trillion Btu's estimated by Hedlin Menzies, a difference of approximately 5 per cent. In addition, the Board notes that the two forecasts embody an identical average annual growth rate of 4 per cent. Hedlin Menzies forecast that the total energy requirements in all sectors would increase from 262 trillion Btu's in 1970 to 811 trillion Btu's in 1999. Over the same period, Foster's adjusted total energy requirements increase from 275 trillion Btu's in 1970 to 853 trillion Btu's in 1999.

The Board observes a difference of some 21 trillion Btu's between the estimates of total energy requirements for 1969. After adjustment by the Board, Foster's 1969 estimates of total energy requirements are 276 trillion Btu's, as compared to 255 trillion Btu's in Hedlin Menzies' forecast. This discrepancy can be explained almost entirely by the difference between the 1969 estimates of petroleum and coal requirements. Foster estimated petroleum and coal requirements to be 54 trillion Btu's in 1969, or some 21 trillion Btu's greater than Hedlin Menzies' estimate of 33 trillion Btu's. In this connection, the Board notes that Foster used a more comprehensive definition of petroleum fuels than Hedlin Menzies, and that the two forecasters employed different sources for historical petroleum and coal statistics.

Despite the fact that Hedlin Menzies and Foster were in reasonably close agreement in their projections of total energy requirements, there are important differences between their



estimates for each type of energy. These differences are attributable partly, but only partly, to the different estimates of historical requirements in 1969. The differences between the forecasts are examined in more detail below.

Over the 30-year forecast period, 1970 to 1999, Hedlin Menzies' projection of gas requirements in the combined industrial and residential and commercial sectors totalled 11,300 trillion Btu's, as compared to Foster's adjusted estimate of 10,613 trillion Btu's. In terms of 10-year totals, the two forecasts are virtually identical for the period 1970 to 1979, with Foster's gas requirements for all sectors totalling 2,480 trillion Btu's as compared to Hedlin Menzies' estimate of 2,451 trillion Btu's. However, the Board notes that the two projections of gas requirements vary significantly over the last twenty years of the forecast. For the period 1980 to 1989, Hedlin Menzies' annual estimates of gas requirements total 3,631 trillion Btu's, as compared to the adjusted estimate of 3,496 trillion Btu's in Foster's forecast. This is a difference of some 4 per cent. Hedlin Menzies' gas requirements for the last ten years of the forecast total 5,218 trillion Btu's, some 13 per cent greater than Foster's adjusted estimate of 4,637 trillion Btu's. The Board believes that the increasing divergence between the two forecasts is mainly due to the fact that Foster predicted more rapid growth in electricity consumption.

The two assessments of electricity consumption varied significantly over the 30-year forecast period. Hedlin Menzies

projected the electricity consumption of all sectors to increase from 28 trillion Btu's in 1970 to 159 trillion Btu's in 1999, the equivalent of an average annual growth rate of 6.2 per cent. Foster projected that electricity consumption would grow at an average annual rate of 8 per cent. In consequence, Foster's electricity requirements, as interpreted by the Board, grow from 29 trillion Btu's in 1970 to 268 trillion Btu's in 1999. As a proportion of annual total energy requirements, electricity consumption in Hedlin Menzies' forecast increases from some 11 per cent in 1970 to approximately 20 per cent in 1999. By contrast, Foster's projections of electricity consumption, as determined from the Board's adjustment, account for some 11 per cent of the total energy requirements in 1970 and increase to some 32 per cent in 1999.

As shown in Table C-9, Hedlin Menzies estimated that petroleum and coal requirements would increase from 32 trillion Btu's in 1970 to 42 trillion Btu's in 1999. Foster, on the other hand, projected that combined petroleum and coal requirements would grow from 46 trillion Btu's in 1970 to 60 trillion Btu's in 1999. The Board believes that the difference between the terminal year estimates can be explained largely by the differences in the respective estimates of these requirements for 1969.

## (2) Fuel Requirements for Power Generation

Table C-10 shows a comparison of Hedlin Menzies' and Foster's forecasts of fuel requirements for the generation of electricity in both the industrial and the residential and commercial sectors.

The Board notes that the two forecasts employed different methods of determining the requirements and, as a result, the forecasts were not comparable in the form originally presented. Foster's yearly estimates of total fuel requirements to generate the power load included requirements for gas, petroleum and coal, and also hydro. By contrast, Hedlin Menzies gave estimates of the additional fuel requirements to generate the anticipated increases in electricity consumption for the period 1970 to 1999. Hedlin Menzies did not show the 1969 levels of fuel requirements to which the increases related, except in the case of gas. Hedlin Menzies obtained the projected requirements for gas, shown in column (1) of Table C-10, by adding its estimates of incremental gas requirements to the 1969 demand level of 38.4 trillion Btu's. For purposes of deriving the levels of petroleum and coal requirements in Hedlin Menzies' forecast, the Board has adopted the 1969 level of requirements shown in Foster's forecast. For future years, the petroleum and coal requirements in Hedlin Menzies' forecast have been calculated by adding to the 1969 level, the difference between Hedlin Menzies' estimates of incremental requirements for all fuels and the incremental requirements for gas. Hedlin Menzies assumed there would be no incremental hydro requirements during the forecast. In order to estimate the levels of total fuel requirements in Hedlin Menzies' forecast, the Board has retained the hydro requirements constant at the level shown for 1969 in Foster's forecast.

On the basis of these adjustments, the Board has compared

Hedlin Menzies' and Foster's forecasts of the fuels required to generate the respective estimates of electricity consumption in the combined industrial and residential and commercial sectors. As calculated by the Board, the total fuel requirements in Hedlin Menzies' forecast grow from 101 trillion Btu's in 1970 to 484 trillion Btu's in 1999, and amount to 7,245 trillion Btu's over the 30-year period. By contrast, Foster's estimates of annual fuel requirements total 12,814 trillion Btu's over the 30-year forecast period, increasing from 107 trillion Btu's in 1970 to 995 trillion Btu's in 1999.<sup>(6)</sup> On a 30-year basis, Foster's estimate of fuel requirements is some 5,569 trillion Btu's greater than Hedlin Menzies' forecast. By 1999, Foster's estimate of annual requirements exceed Hedlin Menzies' forecast by 106 per cent. The Board notes that a difference of 70 per cent in the terminal year estimates is attributable to the different assumptions regarding electricity consumption and that the remainder of the difference reflects different assumptions concerning combustion efficiencies. Differences in the estimates for particular fuels, which are discussed in detail below, reflect additional considerations, such as trends in relative prices, availability of supply and pollution abatement costs.

As shown in columns (1) and (2) of Table C-10, Hedlin Menzies' and Foster's estimates of gas requirements for power generation

---

(6) Foster's estimates relate solely to the fuels required by electric utility companies, whereas Hedlin Menzies' estimates also include fuels required to generate electricity in industrial plants. The Board has not attempted to adjust the two forecasts for power generation to eliminate this inconsistency.

exhibit different growth patterns over the forecast period. Foster projected that the gas requirements would increase from 36 trillion Btu's in 1970, reach a maximum of 101 trillion Btu's in 1989 and decline over the 1992 to 1999 period to 88 trillion Btu's. By contrast, Hedlin Menzies' estimates show a more modest, but continual, growth during the forecast, increasing from 39 trillion Btu's in 1970 to 85 trillion Btu's in 1999.

As columns (3) and (4) of Table C-10 show, Hedlin Menzies and Foster differed widely in their estimates of petroleum and coal requirements for power generation. On a 30-year basis, Foster's estimates of petroleum and coal required for power generation exceed those of Hedlin Menzies by approximately 100 per cent. Both forecasters believed that coal would provide virtually all of the requirements, and that the importance of petroleum would decrease during the forecast. In Hedlin Menzies' forecast, the requirements, as derived by the Board, grow from 48 trillion Btu's in 1970 to 386 trillion Btu's in 1999, the equivalent of an average annual growth rate of 7.4 per cent. By contrast, Foster projected that the volumes of petroleum and coal required for power generation would increase from some 57 trillion Btu's in 1970 to 890 trillion Btu's in 1999, the equivalent of an average annual growth rate of 9.9 per cent. By 1976, the Board notes that Foster's annual petroleum and coal requirements exceed Hedlin Menzies' estimates by about 50 per cent; in 1989, by 100 per cent; and in the terminal year,



by approximately 130 per cent.

Hedlin Menzies assumed that all additional generating capacity would be based on fossil fuels during the forecast period. Foster assumed that all additions to generating capacity would be based on fossil fuels, with the exception of the Big Horn Dam, which was expected to commence operations in 1972. Foster's allowance for this new hydro-electric station is solely responsible for the difference of some 65 trillion Btu's between the forecasters' estimates of 30-year hydro requirements.

The Board has calculated the average volumes of fuel, or heat rates, to generate one KWH of electricity for selected years in the forecasts of both Hedlin Menzies and Foster. As shown in Table C-12, the heat rates calculated from the two forecasts varied widely, especially in the latter years of the forecast period. In column (1) of the Table, the heat rates calculated from Hedlin Menzies' forecast are shown to decline from the 1970 level of 12,401 trillion Btu's to 10,421 trillion Btu's in 1999. This decline reflects Hedlin Menzies' assumption that 10,000 Btu's of fuel would be required in new power stations to generate one KWH of electricity over the forecast period. By contrast, as shown in column (2) of Table C-12, the heat rates calculated from Foster's forecast remain relatively constant at the 1970 level of 12,665 trillion Btu's throughout the forecast period.<sup>(7)</sup> The heat rates calculated from Foster's forecast exceed Hedlin

---

(7) The heat rates which the Board has calculated from Foster's forecast understate the heat rates which are implied in the forecast to the extent that Foster's estimates of total fuel requirements for power generation relate only to electric utility companies.

Menzies' heat rates by 21 per cent in 1999. Therefore, if the estimates of electricity consumption for the terminal year had been the same in the two forecasts, Foster's estimates of total fuel requirements for power generation would have exceeded Hedlin Menzies' estimates by 21 per cent in 1999. However, since Foster's estimate of electricity consumption is some 70 per cent higher than Hedlin Menzies' estimate in 1999, the impact of the different heat rates on total fuel requirements is magnified. Thus, a difference of 36 per cent between the two estimates of total fuel requirements for power generation in 1999 is attributable to the greater heat rate in Foster's forecast.<sup>(8)</sup> Column (3) of Table C-12 shows the heat rates estimated by the City of Edmonton for the Edmonton Power system, on the assumption that all electricity would be generated by gas units during the forecast. The City of Edmonton's estimates of heat rates for the Edmonton Power system exhibit an even more pronounced decline than the heat rates in Hedlin Menzies' forecast and, by 1999, are some 33 per cent less than the estimates in Foster's forecast.

---

(8) The difference of 36 per cent is made up as follows:  
 $0.36 = 0.21 + 0.21 (0.70)$ .

TABLE C-1  
 CONSOLIDATED  
 (HEDLIN MENZIES)  
 FORECAST OF ENERGY REQUIREMENTS  
 RESIDENTIAL AND COMMERCIAL SECTOR  
 (TRILLIONS OF BTU'S)

<u>YEAR</u>	<u>NATURAL GAS</u> (1)	<u>ELECTRICITY</u> (2)	<u>PETROLEUM &amp; COAL*</u> (3)	<u>TOTAL</u> (4)
<u>ACTUAL</u>				
1969	105.7	12.6	22.1	140.4
<u>PROJECTED</u>				
1970	107.8	13.2	20.9	141.9
1971	111.0	13.9	21.2	146.1
1972	115.0	14.6	21.7	151.3
1973	118.9	15.3	22.3	156.5
1974	122.4	16.1	22.6	161.1
1975	126.6	16.9	23.1	166.6
1976	130.3	17.7	23.5	171.5
1977	134.7	18.6	24.0	177.3
1978	138.8	19.5	24.3	182.6
1979	143.3	20.5	24.8	188.6
1980	147.5	21.5	25.1	194.1
1981	152.3	22.6	25.6	200.5
1982	155.6	23.7	25.4	204.7
1983	158.8	24.9	25.3	209.0
1984	162.1	26.1	25.1	213.3
1985	165.4	27.4	24.9	217.7
1986	168.8	28.9	24.4	222.1
1987	172.1	30.3	24.0	226.4
1988	175.3	31.8	23.6	230.7
1989	178.5	33.4	23.0	234.9
1990	181.7	35.1	22.3	239.1
1991	184.9	36.8	21.6	243.3
1992	187.9	38.6	20.8	247.3
1993	191.0	40.5	19.8	251.3
1994	194.0	42.5	18.8	255.3
1995	197.0	44.6	17.6	259.2
1996	200.0	46.8	16.2	263.0
1997	203.0	49.1	15.0	267.1
1998	206.0	51.6	13.4	271.0
1999	208.8	54.2	11.8	274.8
30-YEAR REQUIREMENTS 1970 TO 1999	4,840	877	652	6,368
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.3	5.0	-2.0	2.3

\* THE BOARD HAS ESTIMATED THE PETROLEUM AND COAL REQUIREMENTS FOR THE PERIOD 1970 TO 1999 BY SUBTRACTING THE NATURAL GAS AND ELECTRICITY REQUIREMENTS FROM THE TOTAL ENERGY REQUIREMENTS.

TABLE C-2  
 CONSOLIDATED  
 (HEDLIN MENZIES)  
 FORECAST OF ENERGY REQUIREMENTS  
 INDUSTRIAL SECTOR  
 (TRILLIONS OF BTU'S)

<u>YEAR</u>	<u>NATURAL GAS</u> (1)	<u>ELECTRICITY</u> (2)	<u>PETROLEUM &amp; COAL*</u> (3)	<u>TOTAL</u> (4)
<u>ACTUAL</u>				
1969	90.3	13.7	10.9	114.9
<u>PROJECTED</u>				
1970	94.0	14.7	11.1	119.8
1971	99.2	15.7	11.6	126.5
1972	104.5	16.8	12.2	133.5
1973	110.2	18.0	12.7	140.9
1974	115.9	19.2	13.5	148.6
1975	122.1	20.6	14.0	156.7
1976	128.6	22.0	14.7	165.3
1977	135.4	23.6	15.2	174.2
1978	142.5	25.2	15.9	183.6
1979	150.0	27.0	16.5	193.5
1980	157.5	28.9	17.4	203.8
1981	165.7	30.9	18.1	214.7
1982	174.3	33.0	18.8	226.1
1983	183.4	35.4	19.4	238.2
1984	192.5	37.8	20.4	250.7
1985	202.5	40.5	21.0	264.0
1986	212.9	43.3	21.7	277.9
1987	223.7	46.3	22.4	292.4
1988	235.2	49.6	23.0	307.8
1989	246.7	53.0	24.1	323.8
1990	259.3	56.8	24.6	340.7
1991	272.5	60.7	25.3	358.5
1992	286.2	65.0	25.9	377.1
1993	300.2	69.5	26.9	396.6
1994	315.3	74.4	27.4	417.1
1995	331.2	79.6	27.9	438.7
1996	347.8	85.2	28.3	461.3
1997	365.3	91.1	28.7	485.1
1998	383.5	97.5	29.0	510.0
1999	402.2	104.3	29.7	536.2
30-YEAR REQUIREMENTS 1970 TO 1999	6,460	1,386	617	8,463
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	5.1	7.0	3.5	5.3

\* THE BOARD HAS ESTIMATED THE PETROLEUM AND COAL REQUIREMENTS FOR THE PERIOD 1970 TO 1999 BY SUBTRACTING THE NATURAL GAS AND ELECTRICITY REQUIREMENTS FROM THE TOTAL ENERGY REQUIREMENTS.

TABLE C-3  
 CONSOLIDATED  
 (HEDLIN MENZIES)  
 FORECAST OF ENERGY REQUIREMENTS  
 INDUSTRIAL AND RESIDENTIAL AND COMMERCIAL SECTORS  
 (TRILLIONS OF BTU'S)

<u>YEAR</u>	<u>NATURAL GAS</u> (1)	<u>ELECTRICITY</u> (2)	<u>PETROLEUM &amp; COAL*</u> (3)	<u>TOTAL</u> (4)
<u>ACTUAL</u>				
1969	196.0	26.3	33.0	255.3
<u>PROJECTED</u>				
1970	201.8	27.9	32.0	261.7
1971	210.2	29.6	32.8	272.6
1972	219.5	31.4	33.9	284.8
1973	229.1	33.3	35.0	297.4
1974	238.3	35.3	36.1	309.7
1975	248.7	37.5	37.1	323.3
1976	258.9	39.7	38.2	336.8
1977	270.1	42.2	39.2	351.5
1978	281.3	44.7	40.2	366.2
1979	293.3	47.5	41.3	382.1
1980	305.0	50.4	42.5	397.9
1981	318.0	53.5	43.7	415.2
1982	329.9	56.7	44.2	430.8
1983	342.2	60.3	44.7	447.2
1984	354.6	63.9	45.5	464.0
1985	367.9	67.9	45.9	481.7
1986	381.7	72.2	46.1	500.0
1987	395.8	76.6	46.4	518.8
1988	410.5	81.4	46.6	538.5
1989	425.2	86.4	47.1	558.7
1990	441.0	91.9	46.9	579.8
1991	457.4	97.5	46.9	601.8
1992	474.1	103.6	46.7	624.4
1993	491.2	110.0	46.7	647.9
1994	509.3	116.9	46.2	672.4
1995	528.2	124.2	45.5	697.9
1996	547.8	132.0	44.5	724.3
1997	568.3	140.2	43.7	752.2
1998	589.5	149.1	42.4	781.0
1999	611.0	158.5	41.5	811.0
30-YEAR REQUIREMENTS 1970 TO 1999	11,300	2,262	1,270	14,832
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	3.9	6.2	0.9	4.0

\* THE BOARD HAS ESTIMATED THE PETROLEUM AND COAL REQUIREMENTS FOR THE PERIOD 1970 TO 1999 BY SUBTRACTING THE NATURAL GAS AND ELECTRICITY REQUIREMENTS FROM THE TOTAL ENERGY REQUIREMENTS.



TABLE C-4

CONSOLIDATED  
(HEDLIN MENZIES)

FORECAST OF INCREMENTAL FOSSIL FUEL REQUIREMENTS  
FOR POWER GENERATION  
(TRILLIONS OF BTU'S)

YEAR	TOTAL ELECTRICITY CONSUMPTION (1)	ELECTRICITY CONSUMPTION INCREASE OVER 1969 (2)	FOSSIL FUEL REQUIREMENT INCREASE OVER 1969 (3)	NATURAL GAS REQUIREMENT INCREASE OVER 1969 (4)	PETROLEUM & COAL REQUIREMENT* INCREASE OVER 1969 (5)
<u>ACTUAL</u>					
1969	26.3	0.0	0.0	0.0	0.0
<u>PROJECTED</u>					
1970	27.9	1.6	4.7	1.0	3.7
1971	29.6	3.3	9.7	2.0	7.7
1972	31.4	5.1	14.9	3.1	11.8
1973	33.3	7.0	20.5	4.2	16.3
1974	35.3	9.0	26.4	5.4	21.0
1975	37.5	11.2	32.8	6.7	26.1
1976	39.7	13.4	39.3	8.1	31.2
1977	42.2	15.9	46.6	9.6	37.0
1978	44.7	18.4	53.9	11.1	42.8
1979	47.5	21.2	62.1	12.7	49.4
1980	50.4	24.1	70.6	14.5	56.1
1981	53.5	27.2	79.7	15.4	64.3
1982	56.7	30.4	89.1	16.4	72.7
1983	60.3	34.0	99.6	17.4	82.2
1984	63.9	37.6	110.2	18.5	91.7
1985	67.9	41.6	121.9	19.6	102.3
1986	72.2	45.9	134.5	20.9	113.6
1987	76.6	50.3	147.4	22.2	125.2
1988	81.4	55.1	161.4	23.6	137.8
1989	86.4	60.1	176.1	25.1	151.0
1990	91.9	65.6	192.2	26.7	165.5
1991	97.5	71.2	208.6	28.3	180.3
1992	103.6	77.3	226.5	30.1	196.4
1993	110.0	83.7	245.2	32.0	213.2
1994	116.9	90.6	265.5	34.0	231.5
1995	124.2	97.9	286.9	36.1	250.8
1996	132.0	105.7	309.7	38.4	271.3
1997	140.2	113.9	333.7	41.0	292.7
1998	149.1	122.8	359.8	43.4	316.4
1999	158.5	132.2	387.4	46.2	341.2
30-YEAR REQUIREMENTS 1970 TO 1999	2,262	1,473	4,317	614	3,703

\* THE BOARD HAS ESTIMATED THE INCREMENTAL PETROLEUM AND COAL REQUIREMENTS BY SUBTRACTING THE INCREMENTAL NATURAL GAS FROM THE TOTAL INCREMENTAL FOSSIL FUEL REQUIREMENTS.

TABLE C-5  
ALBERTA & SOUTHERN AND TRANSCANADA  
(FOSTER)

FORECAST OF ENERGY REQUIREMENTS  
RESIDENTIAL AND COMMERCIAL SECTOR\*  
(TRILLIONS OF BTU'S)

YEAR	NATURAL GAS (1)	COAL (2)	PETROLEUM (3)	TOTAL (4)
<u>ACTUAL</u>				
1969	105.7	6.5	22.4	134.6
<u>PROJECTED</u>				
1970	108.9	6.2	21.4	136.5
1971	112.9	6.0	21.7	140.6
1972	116.5	5.7	21.1	144.3
1973	119.9	5.5	22.4	147.8
1974	123.6	5.2	22.7	151.5
1975	127.2	4.9	22.7	154.8
1976	130.9	4.7	23.0	158.6
1977	134.5	4.4	23.4	162.3
1978	138.2	4.2	23.7	166.1
1979	142.0	3.9	24.1	170.0
1980	145.7	3.6	23.9	173.2
1981	149.9	3.1	24.2	177.2
1982	153.7	2.6	24.6	180.9
1983	157.8	2.3	25.0	185.1
1984	161.7	2.0	25.4	189.1
1985	165.7	1.6	25.3	192.6
1986	169.9	1.0	25.7	196.6
1987	174.2	0.5	26.1	200.8
1988	178.4	0.0	26.5	204.9
1989	182.9	0.0	26.8	209.7
1990	187.4	0.0	26.3	213.7
1991	191.8	0.0	25.9	217.7
1992	196.5	0.0	25.8	222.3
1993	201.0	0.0	25.8	226.8
1994	206.0	0.0	25.8	231.8
1995	210.9	0.0	25.7	236.6
1996	216.0	0.0	25.7	241.7
1997	221.0	0.0	25.7	246.7
1998	226.0	0.0	25.6	251.6
1999	231.2	0.0	25.6	256.8
30-YEAR REQUIREMENTS 1970 TO 1999	4,983	67	739	5,788
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.6		0.6	2.2

\* EXCLUDES FUEL REQUIREMENTS FOR POWER GENERATION.

TABLE C-6

ALBERTA & SOUTHERN AND TRANSCANADA  
(FOSTER)FORECAST OF ENERGY REQUIREMENTS  
INDUSTRIAL SECTOR\*  
(TRILLIONS OF BTU'S)

<u>YEAR</u>	<u>NATURAL GAS**</u> (1)	<u>COAL</u> (2)	<u>PETROLEUM</u> (3)	<u>TOTAL</u> (4)
<u>ACTUAL</u>				
1969	180.3	50.3	19.5	250.1
<u>PROJECTED</u>				
1970	199.3	54.4	20.8	274.5
1971	216.7	67.4	21.3	305.4
1972	235.6	73.9	21.6	331.1
1973	250.2	82.4	19.5	352.1
1974	262.4	93.4	19.9	375.7
1975	285.4	100.0	20.3	405.7
1976	294.7	111.1	21.1	426.9
1977	309.9	123.5	22.2	455.6
1978	321.6	134.6	23.0	479.2
1979	331.0	147.7	23.4	502.1
1980	338.1	163.5	23.9	525.5
1981	342.2	182.2	24.4	548.8
1982	358.2	202.4	24.9	585.5
1983	356.7	224.0	25.4	606.1
1984	356.7	247.2	25.9	629.8
1985	362.8	269.2	26.4	658.4
1986	358.5	295.0	26.9	680.4
1987	353.2	322.5	27.5	703.2
1988	333.9	352.1	28.2	714.2
1989	342.1	383.9	28.9	754.9
1990	342.2	421.6	29.5	793.3
1991	348.3	461.7	30.2	840.2
1992	348.5	511.0	31.0	890.5
1993	354.2	555.3	31.8	941.3
1994	353.8	602.4	32.7	988.9
1995	360.5	652.5	33.5	1,046.5
1996	364.5	705.3	34.3	1,104.1
1997	379.3	758.9	35.2	1,173.4
1998	379.1	826.7	36.0	1,241.8
1999	389.0	887.6	36.9	1,313.5
30-YEAR REQUIREMENTS 1970 TO 1999	9,829	10,013	807	20,649
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.3	10.1	2.0	5.5

\* INCLUDES FOSSIL FUEL REQUIREMENTS FOR POWER GENERATION IN BOTH THE INDUSTRIAL AND RESIDENTIAL AND COMMERCIAL SECTORS.

\*\* INCLUDES PERMIT RELATED GAS REQUIREMENTS.

TABLE C-7  
ALBERTA & SOUTHERN AND TRANSCANADA  
(FOSTER)  
FORECAST OF ENERGY REQUIREMENTS\*  
INDUSTRIAL AND RESIDENTIAL AND COMMERCIAL SECTORS  
(TRILLIONS OF BTU'S)

<u>YEAR</u>	<u>NATURAL GAS**</u>	<u>COAL</u>	<u>PETROLEUM</u>	<u>HYDRO***</u>	<u>TOTAL</u>
	(1)	(2)	(3)	(4)	(5)
<u>ACTUAL</u>					
1969	286.0	56.8	41.9	13.8	398.5
<u>PROJECTED</u>					
1970	308.2	60.6	42.2	13.8	424.8
1971	329.6	73.4	43.0	13.8	459.8
1972	352.1	79.6	43.7	13.8	489.2
1973	370.1	87.9	41.9	16.2	516.1
1974	386.0	98.6	42.6	16.2	543.4
1975	412.6	104.9	43.0	16.2	576.7
1976	425.6	115.8	44.1	16.2	601.7
1977	444.4	127.9	45.6	16.2	634.1
1978	459.8	138.8	46.7	16.2	661.5
1979	473.0	151.6	47.5	16.2	688.3
1980	483.8	167.1	47.8	16.2	714.9
1981	492.1	185.3	48.6	16.2	742.2
1982	511.9	205.0	49.5	16.2	782.6
1983	514.5	226.3	50.4	16.2	807.4
1984	518.4	249.2	51.3	16.2	835.1
1985	528.8	270.8	51.7	16.2	867.5
1986	528.4	296.0	52.6	16.2	893.2
1987	527.4	323.0	53.6	16.2	920.2
1988	512.3	352.1	54.7	16.2	935.3
1989	525.0	383.9	55.7	16.2	980.8
1990	529.6	421.6	55.8	16.2	1,023.2
1991	540.1	461.7	56.1	16.2	1,074.1
1992	545.0	511.0	56.8	16.2	1,129.0
1993	555.2	555.3	57.6	16.2	1,184.3
1994	559.8	602.4	58.5	16.2	1,236.9
1995	571.4	652.5	59.2	16.2	1,299.3
1996	580.5	705.3	60.0	16.2	1,362.0
1997	600.3	758.9	60.9	16.2	1,436.3
1998	605.1	826.7	61.6	16.2	1,509.6
1999	620.2	887.6	62.5	16.2	1,586.5

30-YEAR  
REQUIREMENTS  
1970 TO 1999

14,811      10,081      1,545      479      26,916

AVERAGE ANNUAL  
GROWTH RATE  
TO ACHIEVE  
TERMINAL YEAR (%)

2.4      9.7      1.4      0.5      4.6

\* INCLUDES FOSSIL FUEL REQUIREMENTS FOR POWER GENERATION IN BOTH THE INDUSTRIAL AND RESIDENTIAL AND COMMERCIAL SECTORS.

\*\* INCLUDES PERMIT RELATED GAS REQUIREMENTS AND OPERATING REQUIREMENTS OF GAS UTILITY COMPANIES.

\*\*\* THE ENERGY REQUIRED TO GENERATE HYDRO-ELECTRICITY. IN ESTIMATING HYDRO REQUIREMENTS, FOSTER USED A HEAT RATE OF 10,000 BTU'S PER KWH. THE HYDRO REQUIREMENTS WERE NOT ASSOCIATED WITH EITHER THE INDUSTRIAL OR THE RESIDENTIAL AND COMMERCIAL SECTOR.





TABLE C-8  
ALBERTA & SOUTHERN AND TRANSCANADA  
(FOSTER)

FORECAST OF FUEL REQUIREMENTS  
FOR POWER GENERATION\*  
(TRILLIONS OF BTU'S)

YEAR	NATURAL GAS (1)	COAL (2)	FUEL OIL (3)	HYDRO** (4)	TOTAL (5)
<u>ACTUAL</u>					
1969	39.3	41.6	2.9	13.8	97.6
<u>PROJECTED</u>					
1970	35.8	54.4	2.9	13.8	106.9
1971	32.8	67.4	2.9	13.8	116.9
1972	37.2	73.9	2.9	13.8	127.8
1973	40.1	82.4	0.7	16.2	139.4
1974	41.9	93.4	0.7	16.2	152.2
1975	48.9	100.0	0.7	16.2	165.8
1976	52.2	111.1	1.1	16.2	180.6
1977	55.0	123.5	1.9	16.2	196.6
1978	60.6	134.6	2.3	16.2	213.7
1979	65.8	147.7	2.3	16.2	232.0
1980	69.8	163.5	2.3	16.2	251.8
1981	72.2	182.2	2.3	16.2	272.9
1982	74.6	202.4	2.3	16.2	295.5
1983	77.3	224.0	2.3	16.2	319.8
1984	80.0	247.2	2.3	16.2	345.7
1985	85.7	269.2	2.3	16.2	373.4
1986	89.3	295.0	2.3	16.2	402.8
1987	93.3	322.5	2.3	16.2	434.3
1988	97.0	352.1	2.3	16.2	467.6
1989	100.8	383.9	2.3	16.2	503.2
1990	100.8	421.6	2.3	16.2	540.9
1991	100.8	461.7	2.3	16.2	581.0
1992	93.9	511.0	2.3	16.2	623.4
1993	94.4	555.3	2.3	16.2	668.2
1994	94.8	602.4	2.3	16.2	715.7
1995	94.8	652.5	2.3	16.2	765.8
1996	94.8	705.3	2.3	16.2	818.6
1997	96.9	758.9	2.3	16.2	874.3
1998	87.6	826.7	2.3	16.2	932.8
1999	88.4	887.6	2.3	16.2	994.5
30-YEAR REQUIREMENTS 1970 TO 1999	2,258	10,013	64	479	12,814
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.2	10.1	-0.8	0.5	8.0

\* EXCLUDES FUEL REQUIREMENTS FOR POWER GENERATION IN INDUSTRIAL PLANTS.

\*\* THE ENERGY REQUIRED TO GENERATE HYDRO-ELECTRICITY. IN ESTIMATING HYDRO REQUIREMENTS, FOSTER USED A HEAT RATE OF 10,000 BTU'S PER KWH. THE HYDRO REQUIREMENTS WERE NOT ASSOCIATED WITH EITHER THE INDUSTRIAL OR THE RESIDENTIAL AND COMMERCIAL SECTOR.

TABLE  
COMPARISON OF CONSOLIDATED'S  
TRANSCANADA'S FORECASTS OF  
INDUSTRIAL AND RESIDENTIAL  
(TRILLIONS)

YEAR	NATURAL GAS		ELECTRICITY	
	CONSOLIDATED (1)	ALBERTA & SOUTHERN AND TRANSCANADA** (2)	CONSOLIDATED (3)	ALBERTA & SOUTHERN AND TRANSCANADA*** (4)
<u>ACTUAL</u>				
1969	196.0	195.1	26.3	26.3
<u>PROJECTED</u>				
1970	201.8	200.4	27.9	28.8
1971	210.2	208.5	29.6	31.5
1972	219.5	216.3	31.4	34.4
1973	229.1	224.9	33.3	37.6
1974	238.3	238.9	35.3	41.0
1975	248.7	256.5	37.5	44.7
1976	258.9	265.0	39.7	48.7
1977	270.1	280.9	42.2	53.0
1978	281.3	290.5	44.7	57.6
1979	293.3	298.0	47.5	62.6
1980	305.0	304.2	50.4	67.9
1981	318.0	310.0	53.5	73.6
1982	329.9	328.2	56.7	79.7
1983	342.2	334.0	60.3	86.2
1984	354.6	344.3	63.9	93.2
1985	367.9	354.0	67.9	100.7
1986	381.7	364.4	72.2	108.7
1987	395.8	374.8	76.6	117.2
1988	410.5	385.4	81.4	126.2
1989	425.2	396.5	86.4	135.8
1990	441.0	407.9	91.9	146.0
1991	457.4	421.3	97.5	156.8
1992	474.1	431.4	103.6	168.3
1993	491.2	443.3	110.0	180.4
1994	509.3	456.1	116.9	193.2
1995	528.2	469.1	124.2	206.7
1996	547.8	478.4	132.0	221.0
1997	568.3	495.9	140.2	236.0
1998	589.5	509.8	149.1	251.8
1999	611.0	524.0	158.5	268.4
30-YEAR REQUIREMENTS 1970 TO 1999	11,300	10,613	2,262	3,458
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	3.9	3.4	6.2	8.0

\* EXCLUDES FUEL REQUIREMENTS FOR POWER GENERATION.

\*\* EXCLUDES PERMIT RELATED GAS REQUIREMENTS AND OPERATING REQUIREMENTS OF GAS UTILITY COMPANIES.

\*\*\* THE BOARD HAS CALCULATED THE ESTIMATES FOR 1970 TO 1999 BY APPLYING THE GROWTH RATE FOR ELECTRICITY CONSUMPTION AS GIVEN BY ALBERTA & SOUTHERN AND TRANSCANADA (FOSTER), TO THE 1969 LEVEL OF ELECTRICITY, AS GIVEN BY CONSOLIDATED (HEDLIN MENZIES).

C-9

AND ALBERTA & SOUTHERN AND  
ENERGY REQUIREMENTS FOR THE  
AND COMMERCIAL SECTORS\*  
OF BTU's)

PETROLEUM & COAL		TOTAL	
CONSOLIDATED (5)	ALBERTA & SOUTHERN AND TRANSCANADA (6)	CONSOLIDATED (7)	ALBERTA & SOUTHERN AND TRANSCANADA (8)
33.0	54.2	255.3	275.6
32.0	45.5		
32.8	46.1	261.7	274.7
33.9	46.5	272.6	286.1
35.0	46.7	284.8	297.2
36.1	47.1	297.4	309.2
		309.7	327.0
37.1	47.2		
38.2	47.7	323.3	348.4
39.2	48.1	336.8	361.4
40.2	48.6	351.5	382.0
41.3	49.1	366.2	396.7
		382.1	409.7
42.5	49.1		
43.7	49.4	397.9	421.2
44.2	49.8	415.2	433.0
44.7	50.4	430.8	457.7
45.5	51.0	447.2	470.6
		464.0	488.5
45.9	51.0		
46.1	51.3	481.7	505.7
46.4	51.8	500.0	524.4
46.6	52.4	518.8	543.8
47.1	53.4	538.5	564.0
		558.7	585.7
46.9	53.5		
46.9	53.8	579.8	607.4
46.7	54.5	601.8	631.9
46.7	55.3	624.4	654.2
46.2	56.2	647.9	679.0
		672.4	705.5
45.5	56.9		
44.5	57.7	697.9	732.7
43.7	58.6	724.3	757.1
42.4	59.3	752.2	790.5
41.5	60.2	781.0	820.9
		811.0	852.6
1,270	1,548	14,832	15,619
0.9	1.0	4.0	4.0

TABLE  
COMPARISON OF CONSOLIDATED'S  
TRANSCANADA'S FORECASTS OF  
POWER  
(TRILLIONS)

YEAR	NATURAL GAS		PETROLEUM & COAL	
	CONSOLIDATED (1)	ALBERTA & SOUTHERN AND TRANSCANADA (2)	CONSOLIDATED* (3)	ALBERTA & SOUTHERN AND TRANSCANADA (4)
<u>ACTUAL</u>				
1969	38.4	39.3	44.5	44.5
<u>PROJECTED</u>				
1970	39.4	35.8	48.2	57.3
1971	40.4	32.8	52.2	70.3
1972	41.5	37.2	56.3	76.8
1973	42.6	40.1	60.8	83.1
1974	43.8	41.9	65.5	94.1
1975	45.1	48.9	70.6	100.7
1976	46.5	52.2	75.7	112.2
1977	48.0	55.0	81.5	125.4
1978	49.5	60.6	87.3	136.9
1979	51.1	65.8	93.9	150.0
1980	52.9	69.8	100.6	165.8
1981	53.8	72.2	108.8	184.5
1982	54.8	74.6	117.2	204.7
1983	55.8	77.3	126.7	226.3
1984	56.9	80.0	136.2	249.5
1985	58.0	85.7	146.8	271.5
1986	59.3	89.3	158.1	297.3
1987	60.6	93.3	169.7	324.8
1988	62.0	97.0	182.3	354.4
1989	63.5	100.8	195.5	386.2
1990	61.1	100.8	210.0	423.9
1991	66.7	100.8	224.8	464.0
1992	68.5	93.9	240.8	513.3
1993	70.4	94.4	257.7	557.6
1994	72.4	94.8	276.0	604.7
1995	74.5	94.8	295.3	654.8
1996	76.8	94.8	315.8	707.6
1997	79.2	96.9	337.4	761.2
1998	81.8	87.6	360.9	829.0
1999	84.6	88.4	385.7	889.9
30-YEAR REQUIREMENTS 1970 TO 1999	1,766	2,258	5,065	10,078
AVERAGE ANNUAL GROWTH RATE TO ACHIEVE TERMINAL YEAR (%)	2.7	3.2	7.4	9.9

\* THE 1969 PETROLEUM AND COAL REQUIREMENTS WERE ADOPTED FROM ALBERTA & SOUTHERN AND TRANSCANADA'S (FOSTER) SUBMISSION. THE BOARD HAS CALCULATED THE ESTIMATES FOR 1970 BY ADDING THE INCREMENTAL REQUIREMENTS, AS PROJECTED BY CONSOLIDATED (HEDLIN MENZIES), TO THE 1969 DEMAND LEVEL OF 44.5 TRILLION BTU'S.

\*\* THE ENERGY REQUIRED TO GENERATE HYDRO-ELECTRICITY. THE BOARD HAS ADOPTED THE 1969 HYDRO REQUIREMENTS AS GIVEN BY ALBERTA & SOUTHERN AND TRANSCANADA (FOSTER). CONSOLIDATED (HEDLIN MENZIES) ASSUMED THAT ALL ADDITIONAL GENERATING PLANTS AFTER 1969 WOULD BE BASED ON FOSSIL FUELS.

C-10

AND ALBERTA & SOUTHERN AND  
FUEL REQUIREMENTS FOR  
GENERATION  
(OF BTU's)

TOTAL FOSSIL FUELS		HYDRO		TOTAL	
CONSOLIDATED	ALBERTA & SOUTHERN AND TRANSCANADA	CONSOLIDATED**	ALBERTA & SOUTHERN AND TRANSCANADA**	CONSOLIDATED	ALBERTA & SOUTHERN AND TRANSCANADA
(5)	(6)	(7)	(8)	(9)	(10)
82.9	83.8	13.8	13.8	96.7	97.6
87.6	93.1	13.8	13.8	101.4	106.9
88.6	103.1	13.8	13.8	106.4	116.9
97.8	114.0	13.8	13.8	111.6	127.8
103.4	123.2	13.8	16.2	117.2	139.4
109.3	136.0	13.8	16.2	123.1	152.2
115.7	149.6	13.8	16.2	129.5	165.8
122.2	164.4	13.8	16.2	136.0	180.6
129.5	180.4	13.8	16.2	143.3	196.6
136.8	197.5	13.8	16.2	150.6	213.7
145.1	215.8	13.8	16.2	158.8	232.0
153.5	235.6	13.8	16.2	167.3	251.8
162.6	256.7	13.8	16.2	176.4	272.9
172.0	279.3	13.8	16.2	185.8	295.5
182.5	303.6	13.8	16.2	196.3	319.8
193.1	329.5	13.8	16.2	206.9	345.7
204.8	357.2	13.8	16.2	218.6	373.4
217.4	386.6	13.8	16.2	231.2	402.8
210.3	418.1	13.8	16.2	244.1	434.3
244.3	451.4	13.8	16.2	258.1	467.6
259.0	487.0	13.8	16.2	272.8	503.2
275.1	524.7	13.8	16.2	288.9	540.9
291.5	564.8	13.8	16.2	305.3	581.0
309.4	607.2	13.8	16.2	323.2	623.4
328.1	652.0	13.8	16.2	341.9	668.2
348.4	699.5	13.8	16.2	362.2	715.7
369.8	749.6	13.8	16.2	383.6	765.8
392.6	802.4	13.8	16.2	406.4	818.6
416.6	858.1	13.8	16.2	430.4	874.3
442.7	916.6	13.8	16.2	456.5	932.8
470.3	978.3	13.8	16.2	484.1	994.5
6,830	12,335	414	479	7,245	12,814
6.0	8.4		0.5	5.5	8.0



TABLE C-11

AVERAGE HEATING VALUES OF ALBERTA FUELS

	CONSOLIDATED (HEDLIN MENZIES) (1)	ALBERTA & SOUTHERN AND TRANSCANADA (FOSTER) (2)
NATURAL GAS (BTU'S PER CUBIC FOOT)	1,000	1,050
PETROLEUM: (BTU'S PER BARREL)		
KEROSENE AND STOVE OIL	5,800,000	5,677,000
DIESEL FUEL OIL	5,800,000	5,827,000
LIGHT FUEL OIL	5,800,000	5,827,000
HEAVY FUEL OIL	6,300,000	6,287,000
PROPANE	3,800,000	3,843,000
BUTANE		4,309,000
COAL: (BTU'S PER SHORT TON)	20,000,000	
BITUMINOUS		26,200,000
SUB-BITUMINOUS:		
RESIDENTIAL/COMMERCIAL		19,000,000
THERMAL ELECTRIC		16,000,000
LIGNITE		14,000,000
BRIQUETTES		28,000,000
COKE		24,800,000

TABLE C-12

AVERAGE FUEL REQUIREMENTS PER KWH\*

YEAR	CONSOLIDATED** (HEDLIN MENZIES) (1)	ALBERTA & SOUTHERN AND TRANSCANADA** (FOSTER) (2)	CITY OF EDMONTON*** (3)
1969	12,545	12,662	12,057
1970	12,401	12,665	11,820
1975	11,783	12,656	10,689
1980	11,326	12,653	10,094
1985	10,985	12,652	9,705
1990	10,726	12,641	9,637
1995	10,539	12,641	9,588
1999	10,421	12,642	9,521

\* THE BOARD HAS CALCULATED THE AVERAGE FUEL REQUIREMENTS OR THE HEAT RATES BY USING THE FOLLOWING FORMULA:

$$\text{HEAT RATE} = \frac{\text{INPUT FUEL REQUIREMENTS (TRILLIONS OF BTU'S)}}{\text{OUTPUT ELECTRICITY (TRILLIONS OF BTU'S)}} \times 3,412$$

\*\* ALL FUELS, INCLUDING HYDRO. 1KWH = 3,412 BTU's.

\*\*\* NATURAL GAS ONLY. CITY OF EDMONTON'S ESTIMATES FOR EDMONTON POWER.









